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Sanborn®

DIRECT-WRITING OPTICAL OSCILLOGRAPH

MODEL 650

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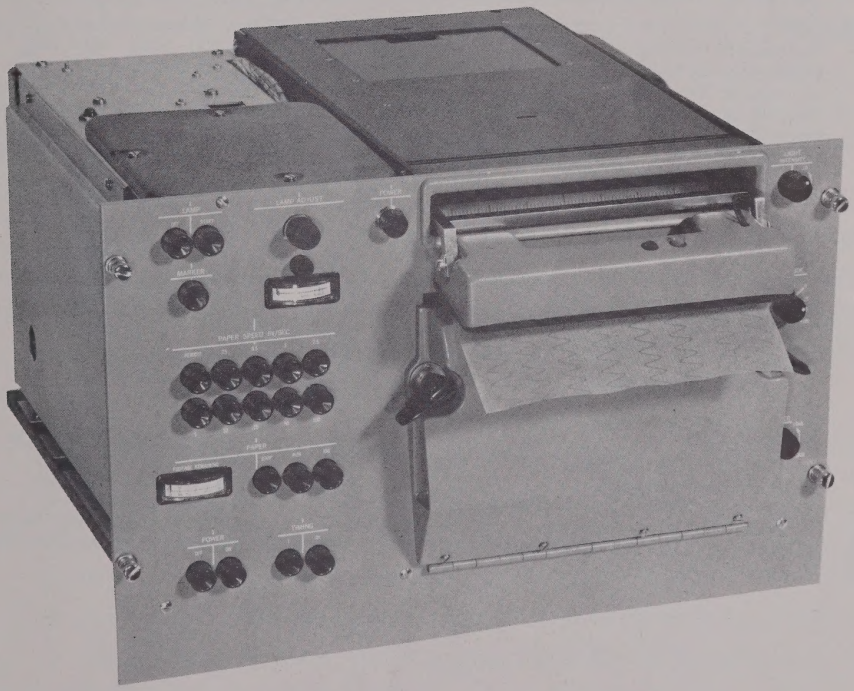
SANBORN COMPANY
WALTHAM 54, MASSACHUSETTS
IM-650-2

CO 25

INSTRUCTION MANUAL

INSTRUCTION MANUAL
SANBORN DIRECT-WRITING
OPTICAL OSCILLOGRAPH

MODEL 650



SANBORN COMPANY

WALTHAM 54, MASSACHUSETTS

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TEL: TW-4-6300
JANUARY 16, 1962

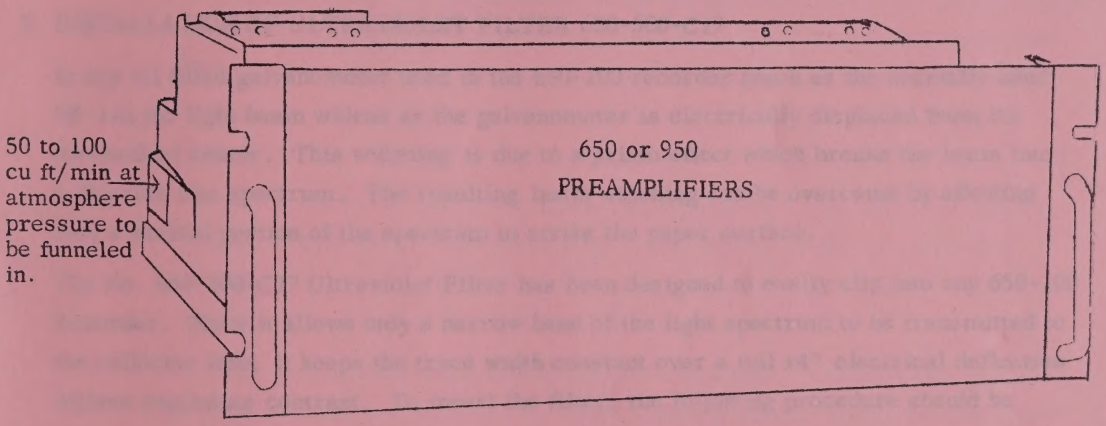
INSTRUCTION MANUAL SUPPLEMENT
IM-650-950-1

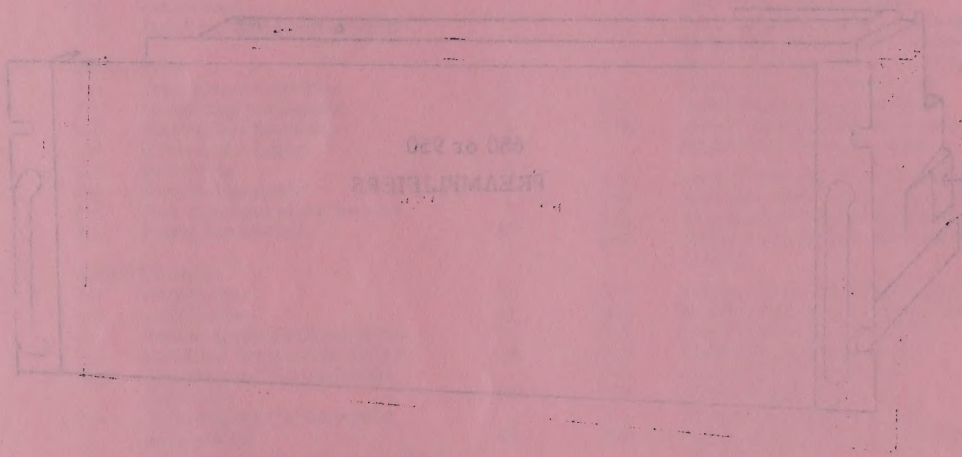
SANBORN 650 AND 950 AMPLIFIERS

CAUTION

Sanborn Amplifiers Models 650 or 950 series require continuous cooling as supplied by Sanborn Cabinet Blowers.

DO NOT operate amplifiers out of cabinet without providing cooling.





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JULY 6, 1962

INSTRUCTION MANUAL SUPPLEMENT
IM-650-2B
SANBORN DIRECT-WRITING
OSCILLOGRAPHIC RECORDER
MODEL 650

1. INTRODUCTION

This supplement includes three items of added information for the operation of your "650":

.....Ultraviolet filter to improve light beam contrast.

.....Reworked light intensity trim, for greater control.

.....Revised procedure for vertical adjustment of the galvanometers.

2. INSTALLATION OF ULTRAVIOLET FILTER 650-300-C17

In any oil filled galvanometer used in the 650-100 recorder (such as the normally used 9B-1A) the light beam widens as the galvanometer is electrically displaced from its mechanical center. This widening is due to a prism effect which breaks the beam into a discrete line spectrum. The resulting beam widening can be overcome by allowing only a limited portion of the spectrum to strike the paper surface.

The No. 650-300-C17 Ultraviolet Filter has been designed to easily clip into any 650-100 Recorder. Since it allows only a narrow band of the light spectrum to be transmitted to the collector lens, it keeps the trace width constant over a full ±4" electrical deflection without degrading contrast. To insert the filter, the following procedure should be used:

1. Loosen the four thumb-screws on the front panel of the 650-100 Recorder and pull out the recorder as far as possible
2. Slide the filter through the small opening directly above the Trace Collector Holder (item 9, figure 13, Appendix of Instruction Manual) so that when all the way in, the filter glass can be swung back and downward, and the clips on either end of the filter can be snapped into the small cutout on the top of the Trace Collector Holder.

Since the filter blocks out essentially all visible light, the filter should be removed if galvanometer vertical positioning is to be checked. Removal procedure is the reverse of the above.

3. REWORKED LIGHT INTENSITY TRIM-650-339

In early units of the 650-100 Recorder the light intensity adjustment is inadequate. This can be detected by opening the front door of the recorder and placing a piece of paper in front of the final collector lens. A static galvanometer trace will appear as a small dot of light, which can be seen through the paper. If the intensity control is rotated fully counter-clockwise the spot should appear to be relatively dim. Clockwise rotation of the control will cause the spot to become brighter. If the optics has been adequately aligned and yet the intensity control has very little or no effect, the following procedure should be followed:

1. Loosen the four screws on the front of the unit which secure the recorder to the cabinet. Pull the recorder out as far as possible. Remove the two screws that hold the Recorder Top Plate in place (items 8 and 7, figure 3, Appendix of Instruction Manual). If there is equipment in the rack directly above the recorder, you will have to remove these screws and plate at the rear of the cabinet before pulling out the recorder.

2. From the top of the unit observe the Light Intensity Trim, 650-339 (item 7, figure 5, Appendix). The latest trim should have a height of 1 inch (0.9 inches in old units). If the incorrect 650-339 is in the unit, replace by removing the three screws which attach it to its bracket.

3. Rotate the intensity control fully counter-clockwise. The Intensity Trim should be fully vertical. If not, with a suitable wrench loosen the nut which holds the light intensity detent switch to its bracket (item 1, figure 3, Appendix) and turn the intensity knob until the trim is vertical. Tighten the nut and rotate the control fully clockwise and then fully counter-clockwise. The trim should now be vertical. Turn on the lamp and again check the unit as outlined in the first paragraph above. The recorder should now be ready for operation.

4. REVISED PROCEDURE FOR VERTICAL ADJUSTMENT OF GALVANOMETERS

The following information replaces the whole of paragraph 3-5, in Instruction Manual IM-650-2. This appears on page 12 of that manual.

The galvanometers (one per channel) can be adjusted vertically to properly distribute the beam from the galvanometer mirror over both the collector lens and the deflection mirror for the viewing window. The correct adjustment should split the beam, which appears as a vertical line, to have an equal amount appearing at both the collector lens and the recorder viewing window. The recorder optical system is shown in figure 3-5.

3. REWORKED LIGHT INTENSITY CONTROL ASSEMBLY

It early units of the 650-100 Recorder the light intensity adjustment is inadequate. This can be detected by opening the front door of the recorder and placing a piece of paper in front of the final collector lens. A steady galvanometer trace will appear as a small dot of light, which can be seen through the paper. If the intensity control is rotated fully counter-clockwise the spot should appear to be relatively dim. Clockwise rotation of the control will cause the light to become brighter. If the optics has been adequately aligned and yet the intensity control has very little or no effect, the following procedure should be followed:

1. Loosen the hex screws on the front of the unit which secure the recorder to the cabinet. Pull the recorder out as far as possible. Remove the two screws that hold the Recorder Top Plate in place (Items 8 and 7, Figure 3, Appendix of Instruction Manual). If there is equipment in the rack directly above the recorder, you will have to remove these screws and plate at the rear of the cabinet before pulling the recorder

2. From the top of the unit observe the Light Intensity Trim, 650-339 (Item 3, Figure 5, Appendix). The inner trim should have a height of 1 inch (0.9 inches in all cases). If the incorrect 650-339 is in the unit, replace by removing the three screws which attach it to its bracket.

3. Rotate the intensity control fully counter-clockwise. The intensity trim should be fully vertical. If not, with a suitable wrench loosen the nut which holds the light intensity detent switch to its bracket (item 1, Figure 3, Appendix) and turn the intensity knob until the trim is vertical. Tighten the nut and rotate the control fully clockwise and then fully counter-clockwise. The trim should now be vertical. Turn on the lamp and again check the unit as outlined in the first paragraph above. The recorder should now be ready for operation.

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The following information replaces the whole of paragraph 3-5, in Instruction Manual IM-650-2. This appears on page 12 of that manual.

The galvanometers (one per channel) can be adjusted vertically to properly distribute the beam from the galvanometer mirror over both the collector lens and the deflecting mirror for the viewing window. The correct adjustment should split the beam, which appears as a vertical line, to leave an equal amount depositing at both the collector lens and the recorder viewing window. The recorder optical system is shown in figure 3-3.

4. REVISED PROCEDURE FOR VERTICAL ADJUSTMENT OF GALVANOMETERS (Cont.)

a. Determining the Need for Vertical Adjustment

1. Turn on the a-c power to the recorder and start the lamp as described in paragraph 2-4.

2. Open the front door. Place a piece of semi-opaque white paper (such as POP Recording paper) immediately in front of and parallel with the final collector lens. A spot of light, corresponding to the galvanometer in question, should be seen through the paper. Rotation of the intensity shutter from fully counter-clockwise to fully clockwise should increase the spot intensity in steps. The corresponding periscope beam should be bright and about .25 inches in height. If the above observations cannot be seen, proceed as follows.

b. Adjusting the Beam

1. Remove the two screws (item 9, figure 3, Appendix which secures the recorder top plate (item 8). Remove the plate. Refer now to Figure 5, Appendix. Looking down at the Light Internal Trim (item 7) notice that when the intensity control is fully counter-clockwise, the Trim is approximately vertical. Turn the intensity control fully clockwise and note that the trim rotates to about 30^{o} above the horizontal. Insert a piece of white paper in a vertical plane between the trim and the viewing window deflection mirror which is slightly above and in front of the trim. The long vertical beam eminating from the galvanometer must now be adjusted so that its top edge will barely cover the deflection mirror when the paper is removed. If the beam appears as a superposition of two separate beams, one above the other, the collimating lens should be slightly adjusted (see paragraph 3-9) so that a single symmetrical beam appears brighter in the center than near the top and bottom edges, with a total height of about 3/4 inches.

The galvanometer beam should always be adjusted so that at first it is too low, since the operation of raising the beam requires that the adjustment tool obscure the beam. Loosen (counter-clockwise) the adjusting screw located on top of the galvanometer block, behind the galvanometer as shown in figure 3-6. The adjusting tool supplied with the accessories (or a No. 4 Allen wrench) is required for the adjustment.

4. REVISED PROCEDURE FOR VERTICAL ADJUSTMENT OF GALVANOMETERS (Cont.)

2. Tighten (clockwise) the screw in front of the galvanometer until the top of the beam is directed below the bottom of the viewing window deflection mirror. (This cannot be seen until the tool is removed). Now loosen this screw.

3. Slowly tighten the screw behind the galvanometer until the top of the beam just covers the deflection mirror. Tighten the front screw until it gently homes. Now tightly home the rear screw noting that the beam is still positioned at its proper place. After all galvanometers are aligned vertically and horizontally (see paragraph 3-6 for horizontal alignment) observe the beam in accordance with paragraph 3-5a.

SECTION 1
DESCRIPTION AND CHARACTERISTICS

1-1. INTRODUCTION

The Sanborn Direct-Writing Optical Oscillograph Model 650 provides permanent records of up to 25 different signals on eight-inch photographic paper, with timing and amplitude lines automatically added.

The optical oscillograph can be used as a portable unit or rack mounted. It provides a connector for remote operation of: paper drive speed selection; starting and stopping the paper drive; changing the timing lines; and, marking the record.

Recording is accomplished by passing a beam of ultraviolet light, reflected from the mirror of an optical galvanometer (one per channel) over ultraviolet sensitive recording paper. The paper, Eastman Kodak Direct Print Linograph, is extremely sensitive to ultraviolet light and relatively unaffected by normal incandescent room lighting.

The exposed record can be stored in a relatively light-free container and does not require developing, washing and temporary fixing. The paper can, however, be permanently fixed if desired.

An automatic beam interrupter is provided for trace identification. The beam interruption appears on the recorded traces from left to right as the paper feeds out of the recorder. The beams are interrupted across the full width of the chart over an approximate eight inch length of the recording.

1-2. INSTALLATION

The recorder can be rack mounted in a system cabinet or installed in a carrying case for use as a portable instrument. If the recorder is mounted in a system cabinet, remove the shipping bracket located at the rear of the recorder in the lower left-hand corner. This bracket prevents the recorder from sliding out of its rack assembly during shipment. Replace the bracket when shipping the recorder.

Check that the line power available for the recorder is at 115 volts ±10% at 60 cps. Connect the recorder or the recording system to the power line with the cord provided.

1-3. INSTALLING PHOTOGRAPHIC PAPER

The recorder is shipped from the factory without the paper installed in the paper compartment. The paper is included with the accessories.

Install the paper in the recorder as follows:

a. Locate the box of photographic paper with the recorder accessories and remove the paper from the box. The paper can be loaded in the recorder under normal room lighting conditions.

b. Open the paper compartment door located on the front of the recorder. The door opens by rotating the lever on each side of the door upward. The door opens out and down.

c. Set the PAPER LOAD/RELEASE control to RELEASE and remove the metal paper spindle from the paper compartment as shown in figure 1-1. Hold one end of the spindle in each hand and pull the spindle apart. (continued on page 5)

Figure 1-1. Removing Paper Spindle

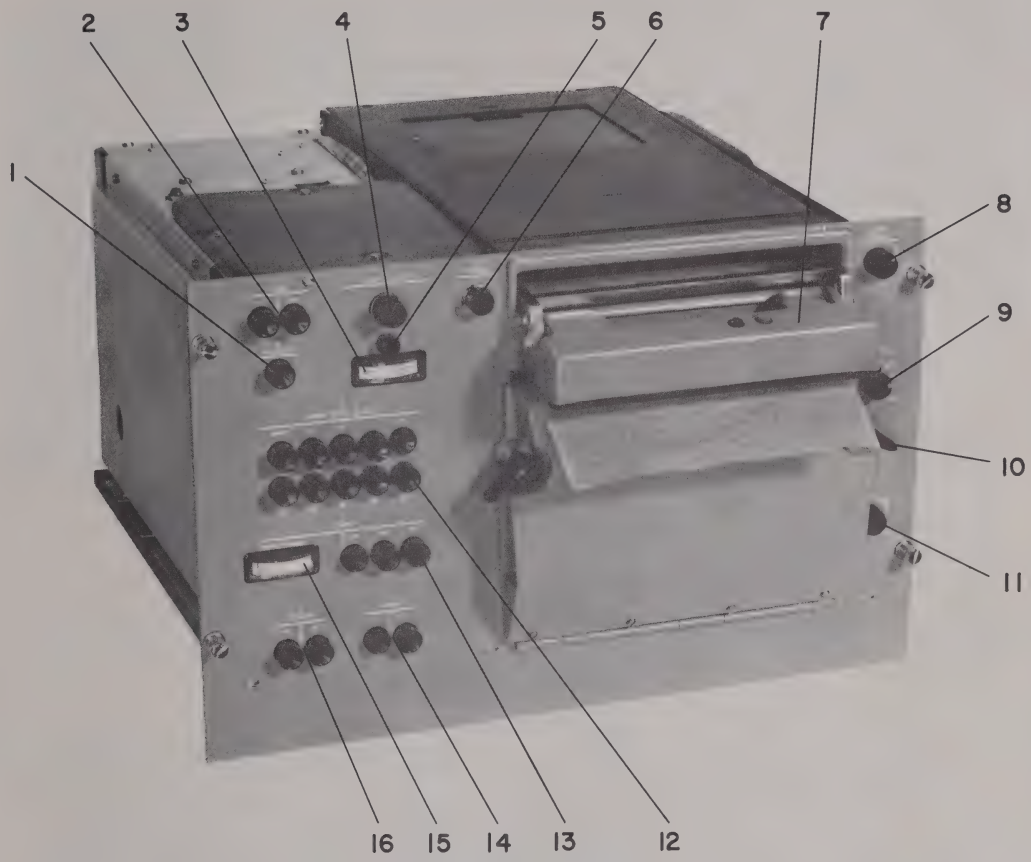
Chart Speeds:	The following nine chart speeds can be electrically selected by push-buttons: 0.25, 0.5, 1.0, 2.5, 5.0, 10, 25, 50 and 100 inches/second.
Chart Width:	Eight inches.
Chart Capacity:	The paper compartment will hold 200 ft. of standard paper (San. No. 3A-15) or 350 ft. of thin base paper (San. No. 3A-16).
Timing Lines:	Timing lines at .01 and 0.1 inch intervals are selected by push-buttons.
Amplitude Lines:	Amplitude lines are at 0.1 inch with the line accentuated at every inch. The amplitude lines can be manually eliminated over 1/4, 1/2 or the total width of the paper.
Galvanometers:	The standard optical galvanometers are Midwestern or equivalent. Resistance damped galvanometers are available at a natural frequency of 500 cps. or lower. Fluid damped galvanometers are available at natural frequencies above 500 cps.
Galvanometer Block:	The standard 8-channel galvanometer block is Midwestern type 158-8 or equivalent. Galvanometer blocks for 14, 18 or 25 channels are also available. Thermistatically controlled galvanometers are available for 14, 18 and 25 channels.
Event Marking:	Exposure of the right-hand edge of the record for marking purposes is available by a push-button on the recorder front panel.
Lamp Current:	Lamp current is adjustable by a front panel control and monitored by a wattmeter and indicator light.

Fuses:

SYMBOL.	DESCRIPTION	LOCATION
F1	5 ampere power fuse	rear panel
F2	1.25 ampere slo-blo motor fuse	rear panel
F3	2.5 ampere lamp start fuse	rear panel

Size:	12-1/4" high, 16-1/2" deep, 19" wide.
Weight:	90 lbs.

Figure 1-2. Direct-Writing Optical Oscillograph Model 650, Specifications.



(1) MARKER
(2) LAMP START-OFF
(3) LAMP WATTMETER
(4) LAMP ADJUST
(5) LAMP CURRENT INDICATOR
(6) RECORDER POWER INDICATOR
(7) POST DEVELOPMENT LAMP
(8) LIGHT INTENSITY
(9) AMPLITUDE LINE TRIM
(10) DOOR RELEASE LEVERS
(11) PAPER LOAD/RELEASE
(12) PAPER SPEED-REMOTE SELECTOR
(13) PAPER DRIVE
(14) TIMING LINE SELECTOR
(15) PAPER FOOTAGE INDICATOR
(16) RECORDER POWER SWITCH

Figure 1-3. Direct-Writing Optical Oscillograph Model 650, Front Panel Controls.

MARKER	(S3) Push-button switch to mark the record. Press button to make a line in the right-hand margin of the photographic paper.
LAMP START-STOP	(S4A, S4B) Two button switch used to start and stop the lamp.
LAMP WATTMETER	(M2) Meter monitors the lamp power.
LAMP ADJUST	(T2) Lamp current adjustment sets the current through the lamp.
LAMP POWER INDICATOR	(I5) Lamp lights when at least two amperes are present in the lamp circuit.
RECORDER POWER INDICATOR	(I1) Lamp lights when a-c power is applied to the recorder.
POST DEVELOPMENT LAMPS	(I3, I4) Lamps are used for post exposure of the record as it comes out of the recorder.
LIGHT INTENSITY	Mechanical adjustment varies the amount of light striking the final collector lens, therefore changing the intensity of the tracings on the photographic paper.
AMPLITUDE TRIM	Mechanical adjustment used to remove the amplitude lines from the photographic paper. The lines can be eliminated over 1/4, 1/2 or all of the photographic record.
DOOR RELEASE LEVERS	Mechanical levers used to open, close and lock the paper compartment door.
PAPER LOAD/RELEASE	Mechanical control used to hold or release the paper spindle.
PAPER SPEED-REMOTE SELECTOR	(S2) Ten button switch used to electrically change the paper speeds.
PAPER DRIVE	(S6A) Three button switch used to STOP, RUN or JOG (momentary run) the photographic paper. In the STOP position the paper is not drawn through the recorder. In the RUN position the paper is drawn through the recorder at the speed selected with the PAPER SPEED control. In the JOG position, the paper is drawn through the recorder at the speed selected by the PAPER SPEED control. However this is a momentary run. The paper will be drawn through the recorder only while the JOG button is pressed and the paper drive will stop as soon as the JOG button is released.
TIMING LINE SELECTOR	(S1B) Two-button switch selects the timing line interval in seconds. Timing lines of 0.1 or 0.01 second intervals can be selected.
PAPER FOOTAGE INDICATOR	(M1) Meter indicates the paper footage remaining on the paper roll.
RECORDER POWER SWITCH	(S1A) Two-button switch turns a-c power to the recorder on and off.

Figure 1-4. Direct-Writing Optical Oscillograph Model 650, Front Panel Data.

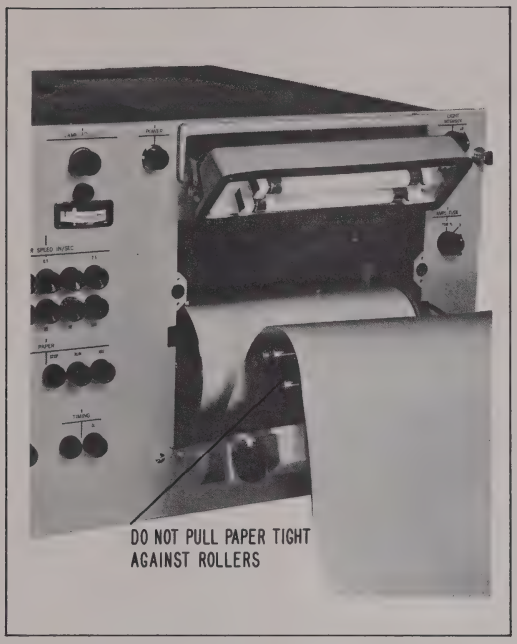


Figure 1-5. Installing Photographic Paper.

d. Push the spindle through the paper roll core as indicated in figure 1-5 and unroll approximately 15 inches of paper from the roll.

e. Place the roll of paper in the compartment as shown in figure 1-5. The roll must press against the black arm protruding from the lower rear of the paper compartment.

   The spindle ends fit into the slots provided on the sides of the paper compartment. The hexagonal spindle end fits the slot on the left side of the paper compartment.

f. Pass the paper out over the rollers fastened to the inner top of the paper compartment door with the sensitized (tan) side up. Allow some slack in the paper remaining in the compartment when the door is closed.

g. Move the PAPER LOAD/RELEASE control to LOAD.

h. Close the paper compartment door. The levers, one on each side of the door, will lock the door when they are pushed in and rotated downward.

CAUTION

The lamp used in this recorder is a mercury vapor lamp. The lamp should not be handled in any manner which might crack the quartz envelope.

Any adjustments internal to the recorder made while the lamp is on should be made in the minimum time possible. This will reduce the possibility of danger to the operator from mercury vapor or mercury coated particles of the lamp envelope if the lamp should explode while any part of the body is near the lamp housing assembly.

The following or similar goggles are recommended to protect the eyes from ultraviolet radiation when looking into the recorder compartment with the lamp on:

F9549G Med. Calobar with Super Armorplate Glass
American Optical Company, Southbridge, Mass.

Z-73 Ray Ban 2 with Bal-Safe Lenses
Bausch & Lomb, Rochester, New York

SYMBOL NO	DESCRIPTION	LOCATION	SANBORN NO	VENDOR NO	SANBORN NO FOR MATING CONNECTOR	VENDOR NO FOR MATING CONNECTOR
J1 thru J25	3-pin male connector for signal input	rear panel	10F3-3MX	XLR-3-32 Cannon	10F3-3FW	XLR-311C Cannon
J26	9-pin female connector for remote operation	rear panel	10F9-1FX	RGK-9-31SL Cannon	10F9-1MW	RGK-9-22C-1/2 Cannon
J27	3-pin male AC receptical	rear panel	10G3-9MX	7486G Hubbell	10G3-10FW	7484 Hubbell

Figure 1-6. Direct-Writing Optical Oscillograph Model 650, Connector Data.

NOTES

SECTION 2
OPERATION

2-1. PRELIMINARY OPERATION

This section of the instruction manual provides the information required for the proper operation of the recorder. Prior to applying power to the recorder, set the front panel controls as shown in figure 2-1.

Now, connect the recorder to the line power with the power cord supplied with the accessories.

2-2. CONNECTING THE SIGNALS

Input signals are applied to the recorder through the input connectors J1 through J25 mounted on the recorder rear panel. The number of input connectors provided is determined by the galvanometer block installed in the recorder, and not on the actual number of galvanometers purchased. If a 25 channel galvanometer block with eight galvanometers is installed in the recorder, 25 input connectors will be mounted on the rear panel.

Signal connections to the recorder for galvanometers operating with current or voltage feedback are shown in figure 2-2.

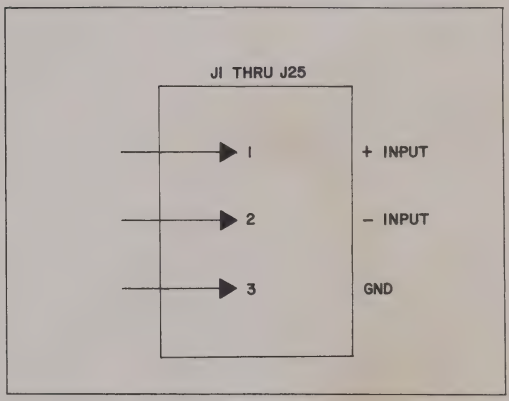


Figure 2-2. Recorder Signal Input Connections.

UNIT	CONTROL	SETTING
RECORDER CONTROL PANEL	POWER SWITCH	OFF
	PAPER DRIVE	STOP
	TIMING SWITCH	EITHER POSITION
	PAPER SPEED SELECTOR	.25 IN/SEC.
	MARKER	OUT
	LAMP OFF/START	OFF
	LAMP CURRENT	FULLY-CLOCKWISE
	AMPLITUDE TRIM	0%
	PAPER LOAD/RELEASE	LOAD
	BEAM INTENSITY	FULL-COUNTERCLOCKWISE

Figure 2-1. Control Settings Prior To Applying Power.

Circuitry for galvanometer damping, compensation, and current limiting must be provided by the amplifier used to drive the recorder galvanometers. Design of this circuitry will be determined by the galvanometer specifications of sensitivity, maximum safe current, damping, and natural resonant frequency.

2-3. STARTING THE RECORDER

Start the recorder as follows:

a. Check that the recorder has been properly connected to the a-c line power of the required voltage and frequency (115 volts, 60 cycles). If the recorder is mounted in a Sanborn system cabinet, turn the a-c power switch located on the master power panel to on. The red indicator light next to the switch should light.

   Now, turn the recorder POWER switch to on. The red light mounted on the recorder front panel should light.

   If the recorder is mounted as a separate instrument, power is controlled by the recorder POWER switch only.

b. Check that the blower located at the bottom of the system cabinet is functioning (for system cabinets) and check that the recorder blower is on. The blower motors should start when the respective power switches are turned on. If the blowers are not functioning, turn the power off immediately. DO NOT OPERATE THE SYSTEM OR THE RECORDER WITHOUT THE BLOWERS ON.

2-4. STARTING THE LAMP

When power is applied to the lamp circuit (recorder POWER switch ON, LAMP OFF and LAMP START buttons out), the wattmeter on the recorder front panel will read full scale. Disregard this reading. The meter reading is valid only when the green light above the meter is on, to indicate that the lamp is on. The green light indicates that at least 2 amperes of current are flowing in the lamp circuit.

Start the lamp as follows:

a. Check that the LAMP CURRENT control on the recorder front panel is fully clockwise. This control should be in the full-clockwise position whenever the lamp is started.

b. Push the LAMP-START button momentarily.

c. As soon as the green light located above the meter lights, adjust the LAMP CURRENT control for a reading of 110 watts on the meter. Keep this 110 watt reading on the meter for one and one half (1-1/2) minutes then adjust the LAMP CURRENT control for a reading of 100 watts on the meter. For extended lamp life, the lamp can be operated at 75 watts providing the decreased lamp intensity is acceptable, and if lamp flicker does not occur.

   If difficulty occurs in reaching the correct power reading on the meter or if lamp flicker occurs, press the LAMP START button momentarily. When the lamp is turned off, wait two (2) minutes before re-igniting the lamp. If the LAMP-START button is pressed for long periods of time (more than approximately 15 seconds out of a 1 minute period) the 2.5 ampere fuse F3 mounted on the rear panel of the recorder will blow. This same fuse will also blow if the recorder vacuum relay sticks in the "on" position. Whenever the vacuum relay buzzing cannot be heard when the lamp does not start, check fuse F3.

2-5. RECORDING

Record data as follows:

a. Check that the amplifier driving the recorder provides the required sensitivity, damping, current limiting and compensation as required.

b. Press the desired paper speed button. The paper speed can be changed with the paper drive either running or stopped.

c. Press the PAPER-RUN button. Set the AMPLITUDE TRIM control to one of its positions as desired.

d. Adjust the LIGHT INTENSITY control for the desired beam intensity. Slower paper drive speeds require less intensity, etc. Experience will determine the proper beam intensity for each recording problem.

2-6. REMOTE OPERATION

The following operations can be controlled from a remote location or at the recorder front panel:

SELECT PAPER DRIVE SPEED
START AND STOP THE PAPER DRIVE
CHANGE THE TIMING LINES
MARK THE RECORD

All of these operations can be controlled at only one location at the time. If the recorder is set up for remote operation and the REMOTE button on the front panel of the recorder is pressed, all four of these operations must be controlled from the remote location. However, control can be returned to the front panel controls, with the remote connections still attached to connector J26, by pressing any one of the PAPER DRIVE SPEED buttons on the recorder front panel to release the REMOTE button.

Remote control of paper drive speeds is accomplished by connecting the +24 volts on pin 4 of connector J26 to the other terminals of the connector as indicated in figure 2-3 for the various paper speeds. The connections can be made through a rotary switch when selection of more than one speed is desired. If only one speed is controlled from the remote location, return the +24 volts at pin 4 of J26 to the proper pin combination indicated in figure 2-3 through a single pull single throw switch.

In all cases of remote operation, diodes (Sarkes-Tarzian F4 or the equivalent) should be included in the lead of the remote circuitry as indicated in figure 2-4 which are connected to the REMOTE connector J26. The diodes when connected as shown in figure 2-4 prevent return voltages from the remote circuit when the operations are controlled from the recorder front panel with the remote connections attached to the recorder through connector J26.

PAPER SPEED (IN/SEC)	RETURN TERMINAL 4 TO TERMINALS
.25	open
.5	6
1.0	6, 7
2.5	5
5.0	5, 6
10	5, 6, 7
25	5, 8
50	5, 7, 8
100	5, 6, 7, 8

Figure 2-3. Remote Paper Speed Connections.

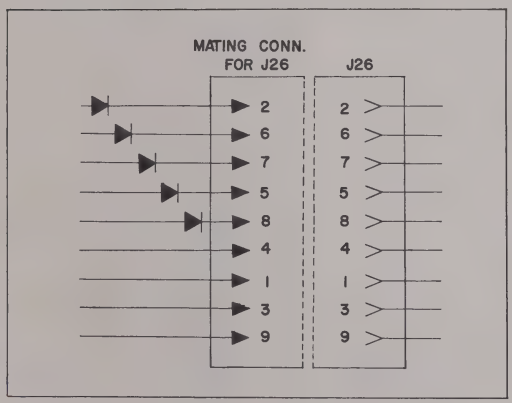


Figure 2-4. Remote Connections With Diodes In Circuit.

MARKER The marker return is terminal 3. Connect terminals 3 and 4 to a single-pole single-throw switch; close the switch to mark the record.

PAPER DRIVE START-STOP The paper drive return is terminal 2. Connect a single-pole single-throw switch to terminal 2 and 4; close switch to start, open switch to stop.

TIMING LINES The timing line return is terminal 1. Connect terminals 1 and 4 to a single-pole single throw switch. With the switch open, 0.1 second timing lines will be printed on the paper. With the switch closed, 0.01 second timing lines will be printed on the paper.

PAPER SPEED SELECTOR Terminals 5, 6, 7 and 8 are the returns for the paper speed relays. Return terminal 4 (+24 volts) to the terminals indicated in figure 2-3 for the desired paper speeds.

2-7. POST EXPOSURE OF THE RECORD

The following methods are suggested for post exposure of the record:

a. Ambient Ultraviolet Light

When the recorder is operated where fluorescent room lighting is used, the record will be post exposed quickly (approximately 1 minute) as it feeds out of the recorder. This post exposure is caused by the ambient ultraviolet light present in the fluorescent lighting and presents clear, well defined traces of the recorded data.

CAUTION

Further exposure (for many hours) to ambient ultraviolet light after the desired post exposure will cause over exposure. Therefore the record, if not permanently fixed must be stored in a light tight container.

If the record is to be used, after the desired post exposure, where ambient ultraviolet conditions exist, the record can be permanently fixed as described in paragraph 2-8. After fixing, the record will be unaffected by further exposure to ultraviolet light.

b. Post Exposure Lamp

Since the record is unaffected by incandescent lighting, a developing lamp assembly is available for post exposure of the record as it leaves the

recorder. This developing lamp is required when the recorder is operated where ultraviolet light is not available or when faster post exposure is desired.

2-8. FIXING THE RECORD

The record can be permanently fixed. Fixing is required if the record is to be used for a long period of time (several hours or more) where ambient ultraviolet light is present.

Fix the record as follows: *

a. Mix the developer as indicated on the container. With the developer at approximately 70°F, process the record in the developer for approximately 75 seconds. Developing time is best determined by experimentation.

b. Follow the developing with a 10 second stop-bath.

c. Fix the record in Kodak Linograph or Kodak Fixer. Keep all of the record immersed at all times during the fixing period. This treatment will change the exposed area from black to blue and the background area from tan to light gray.

d. After fixing, wash the record in running water at 70°F for approximately 20 minutes.

Identifying marks and notes can be made on the record with pen or pencil.

* Procedure established for Kodak Linograph Direct-Print Permanizing Developer.

NOTES

SECTION 3
MAINTENANCE

3-1. INTRODUCTION

This section of the instruction manual provides the operator with information for the routine maintenance of the recorder. Generally, all the adjustments described in this section are factory set and will require readjustment only in the event of faulty operation or after component changes.

Access to the recorder for maintenance purposes can be made by sliding the recorder out of the cabinet on its slide assembly (if the recorder is mounted in a system cabinet) or the recorder can be placed on a work bench.

CAUTION

Do not attempt to move the recorder without help. Remove all cables and connections to the recorder prior to removing the recorder from the cabinet or case in which it is mounted.

3-2. LUBRICATION

Check and lubricate the blower motor located at the bottom of the system cabinet (when the recorder is mounted in a cabinet) at least every three months with Sanborn Recorder Lubricating Oil No. 39LU-8. For 24 hour-a-day operation more frequent lubrication checks should be made.

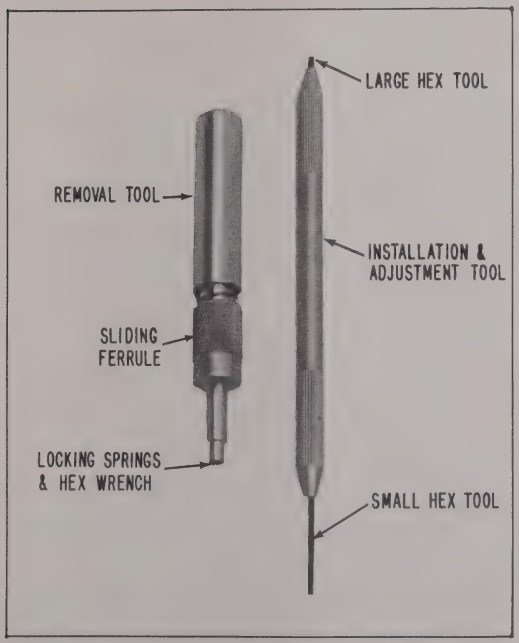


Figure 3-1. Galvanometer Adjustment Tools.

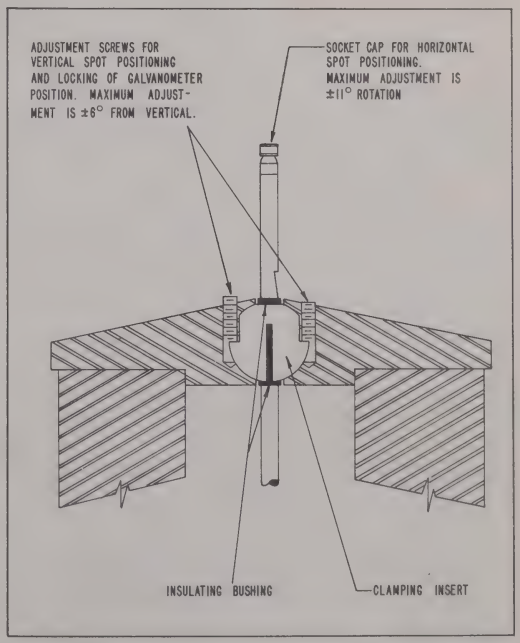

ADJUSTMENT SCREWS FOR VERTICAL SPOT POSITIONING AND LOCKING OF GALVANOMETER POSITION. MAXIMUM ADJUSTMENT IS ±6° FROM VERTICAL.
SOCKET CAP FOR HORIZONTAL SPOT POSITIONING. MAXIMUM ADJUSTMENT IS ±11° ROTATION
INSULATING BUSHING
CLAMPING INSERT

Figure 3-2. Magnetic Block, Cross Section.

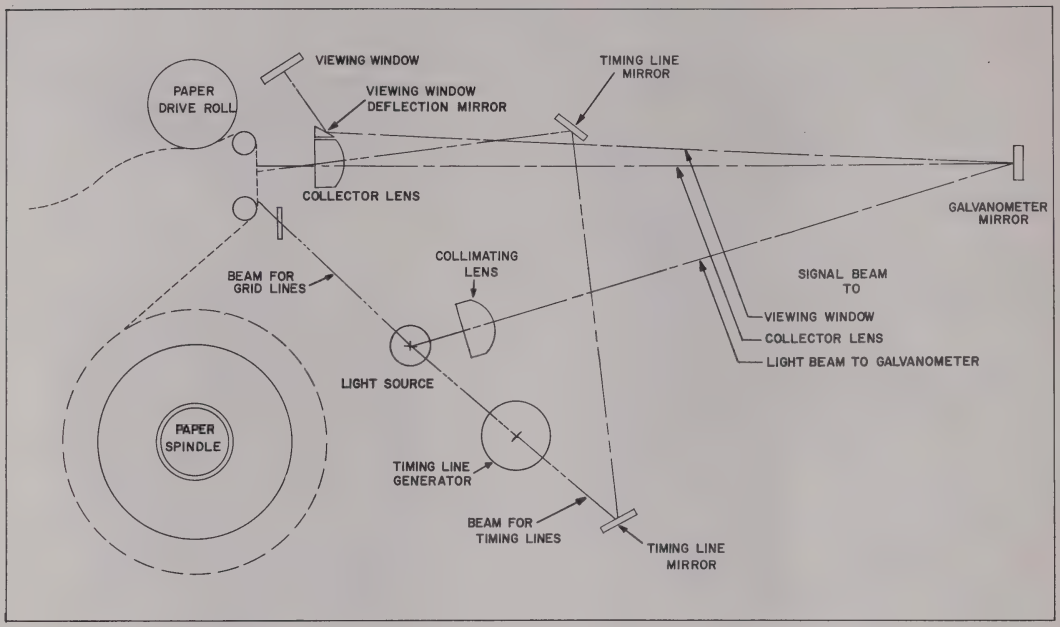


Figure 3-5. Recorder Optical System.

c. Insert the adjusting tool in the hole provided on top of the galvanometer as shown in figure 3-7. While observing the beam in the recorder viewing window, turn the galvanometer either to the right or left to mechanically center the galvanometer.

3-7. ADJUSTING THE GALVANOMETER BLOCK TEMPERATURE

Galvanometer blocks for 14, 18, and 25 channels can be ordered with a heater installed to keep the galvanometers at a constant temperature of $100^{o}F \pm 5^{o}$.

Adjust the galvanometer block temperature as follows:

a. Remove the galvanometer from the block as described in paragraph 3-3 and apply power to the galvanometer block.

b. Insert a thermocouple lead into each hole.

c. Remove the protective cover from the heater and using a screwdriver adjust the heater for $100^{o}F \pm 5^{o}$ as shown in figure 3-8.

d. Remove the thermocouple and install the galvanometer as described in paragraph 3-4.

3-8. ADJUSTING THE LIGHT INTENSITY

The LIGHT INTENSITY control positions a shutter which limits the magnitude of the beam projected on to the collector lens from the galvanometer mirror. This shutter therefore varies the intensity of the beam applied to the photographic paper from the collector lens.

Figure 3-6. Vertical Adjustment.

Figure 3-7. Horizontal Adjustment.

While viewing the trace on the finished record, adjust the LIGHT INTENSITY control for the desired trace intensity. As in oscilloscopes, too great a beam intensity may be deterrent to clear trace definition.

3-9. ADJUSTING THE COLLIMATING LENS

The collimating lens is mounted in an adjustable frame on the lamp enclosure. The lens projects the light from the source as a horizontal bar across the galvanometer mirrors. The collimating lens adjustment, by raising or lowering the lens, moves this horizontal "bar" of light either up or down, to place the greatest concentration of light across the galvanometer mirrors. This adjustment should be checked after installing a new lamp, or after changing the vertical galvanometer positioning.

Determine if adjustment is required and adjust the collimating lens as follows:

a. Remove the four screws located on the recorder front panel which hold the recorder to the case or cabinet and slide the recorder out to its maintenance position.

b. Turn on the a-c power to the recorder and start the lamp as described in paragraph 2-4.

c. Slide open the door located on top and to the rear of the recorder and look down at the galvanometer mirrors.

CAUTION

Protective goggles such as those mentioned in paragraph 1-3 should be worn when looking into the recorder with the lamp on. The goggles protect the eyes from ultraviolet radiation.

d. Look at the glavanometer mirrors through the open door and observe where most of the light from the source is being projected. Most of the light should be striking the mirrors. If the heaviest concentration is striking the mirrors, no adjustment is required. However, if most of the light is projected either above or below the mirrors, adjustment is required. Determine in what direction the light "bar" must move

e. Locate the collimating lens adjustment. The screw is on the right side of the recorder as shown in figure 3-9. If the light is striking too low on the galvanometer, turn the screw clockwise to raise the beam. If the light is striking to high on the galvanometer, turn the screw counter-clockwise to lower the beam.

3-10. ADJUSTING THE COLLECTOR LENS (FOCUS)

This adjustment should never require re-adjustment under normal operating and shipping conditions.

Figure 3-8. Galvanometer Block Temperature Adjustment.

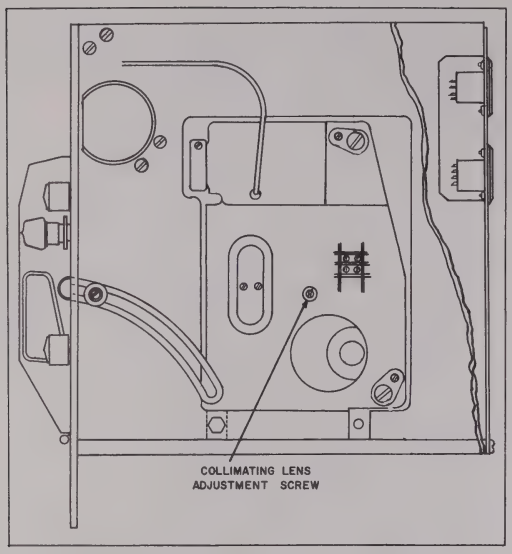


Figure 3-9. Collimating Lens Adjustment.

The collector lens is adjustable (front-to-back) to focus the beams from the galvanometer mirrors on to the photographic paper.

Adjust the focus as follows:

a. Turn on the a-c power to the recorder and start the lamp as described in paragraph 2-4.

b. Open the paper compartment door located on the front of the recorder and locate the collector lens at the top rear of the paper compartment. An adjusting screw is located at each end of the lens on the lens mounting fixture as shown in figure 3-10. The lens and mounting fixture are spring loaded in the recorder.

c. Adjust both screws evenly to set the distance from the lens mounting fixture to the front of the recorder front panel at approximately 2.8 inches as indicated in figure 3-10.

d. If after observing the traces on the photographic paper a finer focal adjustment is desired, the collector lens can be moved towards the rear of the recorder (turning the screws clockwise) or towards the front of the recorder (turning the screws counter-clockwise) for the desired focal setting.

3-11. ADJUSTING THE TIMING MIRRORS

The timing lines are formed by interrupting a beam from the lamp. The beam is then deflected on to the collector lens by two mirrors. These two mirrors are cam-mounted and can be adjusted from the right hand side of the recorder as shown in figure 3-11.

When properly adjusted, the timing beam should be deflected as shown in figure 3-12. Mirror (1) should be set to deflect the beam to the center of mirror (2) and mirror (2) set to deflect the beam on to the center of the collector lens.

Adjust the mirrors as follows:

a. Remove the four screws, located on the recorder front panel, which hold the recorder to the case or cabinet and slide the recorder out to its maintenance position.

b. Turn on the a-c power to the recorder and start the lamp as described in paragraph 2-4.

c. Remove the panel located on the top right of the recorder. This panel includes the door used for viewing the galvanometers and the galvanometer block.

d. Locate the adjusting screws (two for each mirror) on the right side of the recorder. The screws are shown in figure 3-11. Screws (a) and (b) are the cam locking screws; Screws C and D are the cam adjusting screws.

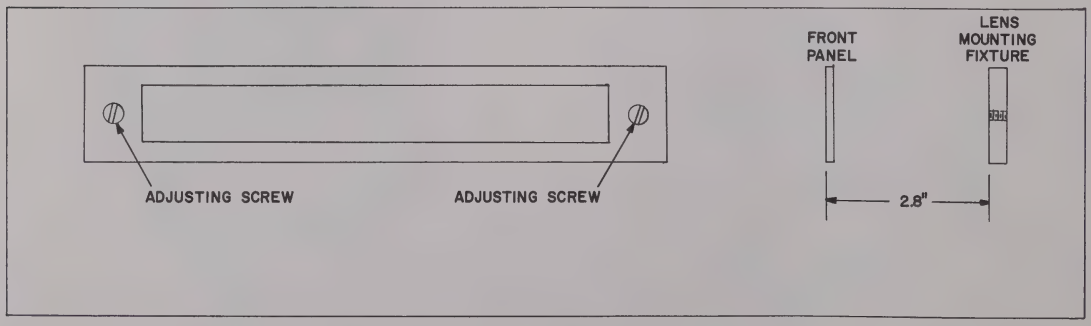


Figure 3-10. Collector Lens Adjustment.

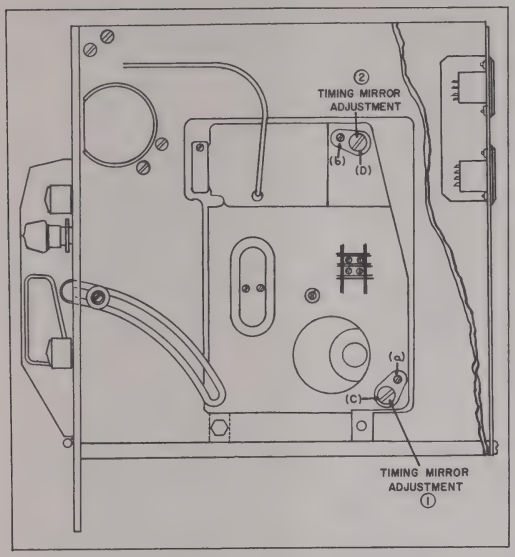


Figure 3-11. Timing Mirror Adjustment.

e. To adjust mirror (1), loosen screw (a) and turn screw C to move the mirror for the required beam deflection. The mirror should deflect the beam to the center of mirror (2). Now, tighten screw (a).

f. To adjust mirror (2), loosen screw (b) and turn screw D to move the mirror for the required beam deflection. This mirror should deflect the beam to the center of the collector lens. Now, tighten screw (b).

3-12. REPLACING THE MERCURY VAPOR LAMP

Replace the mercury vapor lamp as follows:

a. Turn the recorder POWER switch and the LAMP OFF-START switch to OFF. Disconnect the power cord from the a-c line voltage outlet. Press the LAMP-START switch.

   This procedure insures that no voltage is present when the lamp is replaced and the lamp filtering capacitor is discharged to ground.

b. Allow the lamp to cool for 15 minutes.

c. Open the paper compartment door located on the front of the recorder and remove the roll of paper. The door to the lamp housing assembly is located on the rear wall of the paper compartment. The door appears as shown in figure 3-13.

d. Turn the two screws shown in figure 3-13 counter-clockwise 1/4 turn and open the door. The lamp is installed as shownin figure 3-14.

e. Grasp the lamp by the metal cap at the ground (cathode) end.

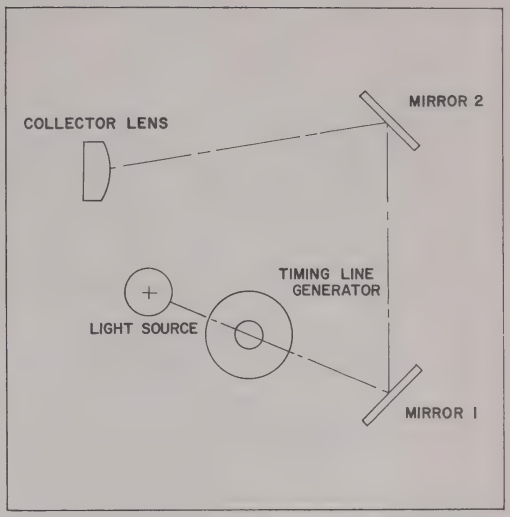


Figure 3-12. Timing Mirror Alignment

CAUTION

This lamp contains 75-100 atmospheres pressure when hot. DO NOT hold the lamp in any way which may crack its quartz envelope.

f. Before installing the new lamp, clean the housing contacts to prevent arcing and corrosion. Failure to maintain low contact resistance will increase wattage dissipation at the lamp contacts, ultimately causing lamp failure.

g. Carefully remove the new lamp from the carton. Keep its quartz envelope clean and free of grease marks and fingerprints. If possible, wash the lamp in alcohol and distilled water before installation. Fingerprints and grease etch into the quartz envelope, ultimately weakening the envelope.

h. Carefully install the lamp to have it held by the clamp at each end, in the position shown in figure 3-14.

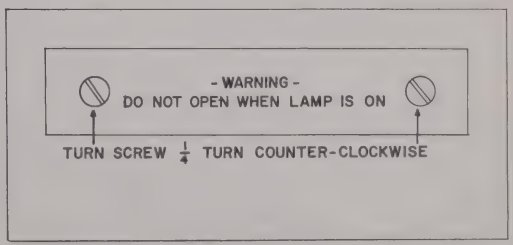


Figure 3-13. Lamp Housing Assembly Door.

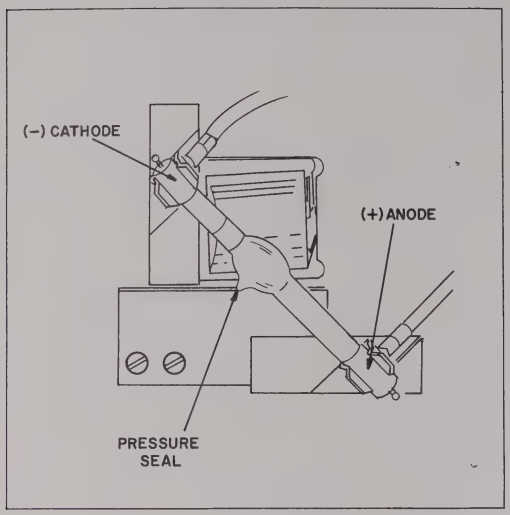


Figure 3-14. Mercury Vapor Lamp Installation.

3-13. WATTMETER CALIBRATION

A potentiometer (R12) is provided in the lamp circuit to calibrate the wattmeter. This adjustment is made at the factory and should require readjustment only in the event of component changes in the lamp circuit, other than the lamp itself, or if the meter accuracy is questionable.

Calibrate the meter as follows:

a. Remove the lamp from the recorder as described in paragraph 3-12.

b. Connect an accurate 4.0 ohm, 200 watt resistor in parallel with a capacitor of 1000 mfd or higher with a voltage rating of 100 volts or better.

c. Insert the parallel combination in the recorder in place of the lamp. (Capacitor (+) side at the lamp ANODE clamp.)

d. Check that the LAMP-OFF and LAMP-START buttons are in the out position and the recorder POWER switch is OFF.

e. Connect the recorder or system to the a-c line power with the power cord provided.

f. Remove the four screws located on the recorder front panel which hold the recorder to the case or cabinet and slide the recorder out ot its maintenance position.

g. Turn on the a-c power to the recorder and set the LAMP ADJUST control for a reading of 20 volts across the 4.0 ohm resistor.

Now, adjust the METER ADJ. potentiometer located on the top panel of the recorder for a reading of 100 watts on the front panel WATTMETER.

NOTES

RECORDER LUBRICA

The Recorder has bee
2000 hours operation

To lubricate the Recc

....Open rear door c

....Disconnect cable

....Pull Recorder ou
CAUTION: The

....Remove the Recc
Recorder bottom

....Remove the Recc

....Remove the gear

....Remove the Recc

....Remove relay co

....Remove the scre
rear plates.

....Lift the upper ch
connect or damag

....Remove the four
cover.

Lubricate the followi

Oil all copper co
equivalent.

Oil all spacers n

Grease all gears
exposed will be g

Do not over lubr

Lubricate the tin
Corning).

The motor does not r

Do not allow any grea

Replace the:

....Upper chassis a

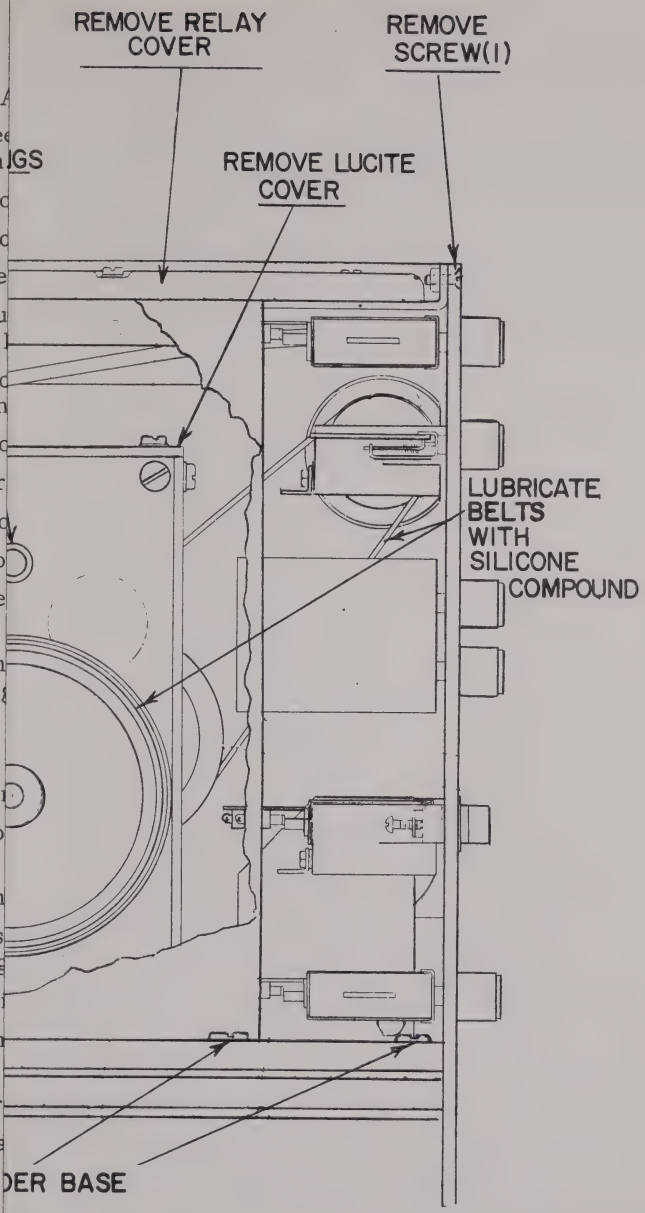
....Relay cover.

....Top plate.

....Left side plate.

....Recorder into ca

....Connect cables a



LUBRICATION
SANBORN RECORDER
MODEL 650

SANBORN COMPANY

WALTHAM MASS.
AUGUST 1961

LC-650-1

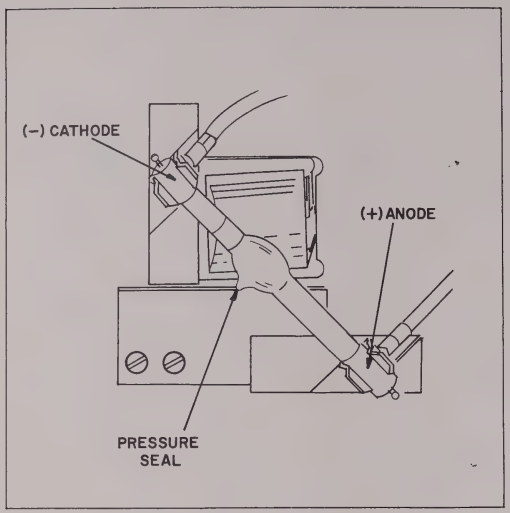


Figure 3-14. Mercury Vapor Lamp Installation.

3-13. WATTMETER CALIBRATION

A potentiometer (R12) is provided in the lamp circuit to calibrate the wattmeter. This adjustment is made at the factory and should require readjustment only in the event of component changes in the lamp circuit, other than the lamp itself, or if the meter accuracy is questionable.

Calibrate the meter as follows:

a. Remove the lamp from the recorder as described in paragraph 3-12.

b. Connect an accurate 4.0 ohm, 200 watt resistor in parallel with a capacitor of 1000 mfd or higher with a voltage rating of 100 volts or better.

c. Insert the parallel combination in the recorder in place of the lamp. (Capacitor (+) side at the lamp ANODE clamp.)

d. Check that the LAMP-OFF and LAMP-START buttons are in the out position and the recorder POWER switch is OFF.

e. Connect the recorder or system to the a-c line power with the power cord provided.

f. Remove the four screws located on the recorder front panel which hold the recorder to the case or cabinet and slide the recorder out ot its maintenance position.

g. Turn on the a-c power to the recorder and set the LAMP ADJUST control for a reading of 20 volts across the 4.0 ohm resistor.

Now, adjust the METER ADJ. potentiometer located on the top panel of the recorder for a reading of 100 watts on the front panel WATTMETER.

NOTES

LUBRICATION INSTRUCTIONS

SANBORN 650 RECORDER

RECORDER LUBRICATION

The Recorder has been lubricated at Sanborn Company but will require lubrication after 2000 hours operation.

To lubricate the Recorder follow these steps:

....Open rear door of cabinet.

....Disconnect cables connected to Recorder rear.

....Pull Recorder out to its extended position.
CAUTION: The Recorder weighs approx. 115 lbs and requires two men to remove it.

....Remove the Recorder from the cabinet by removing the four screws from each side of Recorder bottom base. These screws hold the Recorder to the rack slide.

....Remove the Recorder from the cabinet.

....Remove the gearbox and motor cover, located on left side of the Recorder.

....Remove the Recorder top plate.

....Remove relay cover (Royalite) from the upper chassis assembly.

....Remove the screws which hold the upper chassis assembly to the center, front and rear plates.

....Lift the upper chassis assembly up to facilitate access to the gear box. Do not disconnect or damage any leads.

....Remove the four screws holding down the lucite cover on gear box. Remove lucite cover.

Lubricate the following:

Oil all copper colored oilite bearings visible on gear box plates with Mobil DTE or equivalent.

Oil all spacers next to clutch adapters with Mobil DTE or equivalent.

Grease all gears and sprockets with Anderol 793 or equivalent. Gears that are not exposed will be greased by exposed mating gears.

Do not over lubricate.

Lubricate the timing belts with a silicone lubricant such as 4X Compound (Dow Corning).

The motor does not require lubrication.

Do not allow any grease to come in contact with the rubber drive roll.

Replace the:

....Upper chassis assembly.

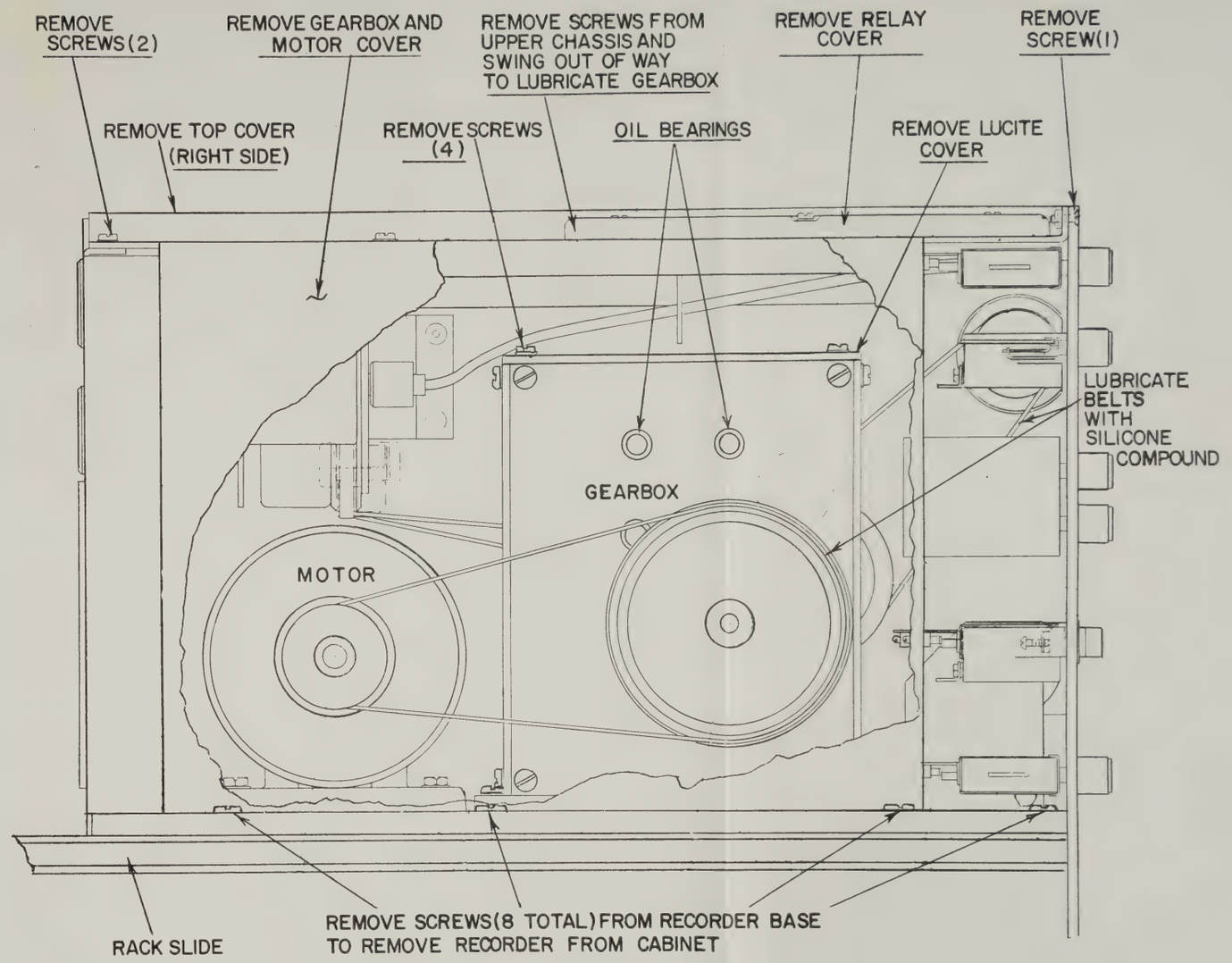
....Relay cover.

....Top plate.

....Left side plate.

....Recorder into cabinet, secure it onto rack slide.

....Connect cables at rear of Recorder.


REMOVE SCREWS(2)
REMOVE GEARBOX AND MOTOR COVER
REMOVE SCREWS FROM UPPER CHASSIS AND SWING OUT OF WAY TO LUBRICATE GEARBOX
REMOVE RELAY COVER
REMOVE SCREW(1)
REMOVE TOP COVER (RIGHT SIDE)
REMOVE SCREWS (4)
OIL BEARINGS
REMOVE LUCITE COVER
LUBRICATE BELTS WITH SILICONE COMPOUND
GEARBOX
MOTOR
RACK SLIDE
REMOVE SCREWS(8 TOTAL) FROM RECORDER BASE TO REMOVE RECORDER FROM CABINET

SANBORN OSCILLOGRAPHIC
RECORDER MODEL 650-100
LEFT SIDE VIEW

LUBRICATION
SANBORN RECORDER
MODEL 650

SANBORN COMPANY

WALTHAM MASS.
AUGUST 1961

LC-650-1

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
AUGUST 1, 1961

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2A

SANBORN DIRECT-WRITING OSCILLOGRAPHIC
RECORDER MODEL 650-100

RPL-650-100-2A
CR11812 6/13/61
Schematic: 650-100-C1 Sub 4

Sanborn Direct-Writing Oscillographic Recorder Model 650-100 stamped with CR11812 or higher will have the following change:

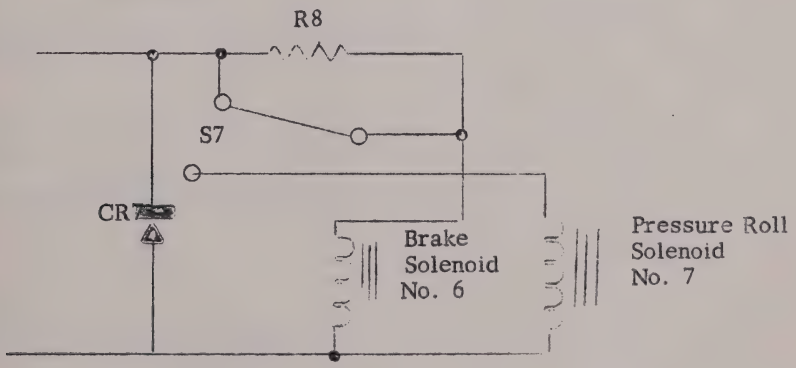
Symbol number of C5 on S2 Switch changed C6- .1 Mfd. ±20% 200V.

CR11873 7/28/61 STANDARD CHANGE
Schematic: 650-100-C1 Sub 5

Sanborn Direct-Writing Oscillographic Recorder Model 650-100 stamped with CR11873 or higher will have the following changes:

The Pressure Roll solenoid No. 7 is rewired as shown in the diagram.

This change assures the correct solenoid operation to protect the gearing.



SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
AUGUST 24, 1961

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2B

SANBORN DIRECT-WRITING OSCILLOGRAPHIC
RECORDER MODEL 650-100

RPL-650-100-2B
CR11921 8/4/61

Figure 29 Shaft #2 Ref. No. 3

Sanborn Number changed from 358-700-C4P1 to: 650-700-C12

Figure 29 Shaft #3 Ref. No. 11

Sanborn Number changed from 358-700-C4P2 to: 650-700-C13

Figure 29 Shaft #4 Ref. No. 3

Sanborn Number changed from 358-700-C1P4 to: 650-700-C14

Figure 31 Ref. No. 2

Sanborn Number changed from 5G-36 to: 5G-102

Figure 32 Ref. No. 3

Sanborn Number changed from 5G-36 to: 5G-102

Figure 33 Ref. No. 4

Sanborn Number changed from 5G-36 to: 5G-102

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
NOVEMBER 6, 1961

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2C

SANBORN DIRECT-WRITING OSCILLOGRAPH
MODEL 650 , 650T

RPL-650-100-2C
STANDARD CHANGE
CR12064 10/3/61

Sanborn Direct-Writing Oscillograph 650, 650T stamped with CR12064 or higher will have the following changes.

Refer to Figure 14 of Mechanical Parts List Ref. No. 1. Support Lamp Assembly (upper) is deleted.

Support Lamp Upper 650-332 Sub 4 is used.

Ref. No. 2 High Voltage Electrode Assembly is deleted.

Clip and Bar Assembly 650-300-C13 is used.

Consists of:

Upper Bar Lamp	650-347
Fuse Clip	12A-4
Rivet	47E-16

Ref. No. 7 Lamp Support Assembly (Lower) is redesigned.

New designed Lamp Support Assembly Lower - Sanborn No. 650-300-C7 Sub 2 is used.

Consists of:

Support, Lamp (Lower)	650-331 Sub 4.

Ref. No. 10 Clip Lamp is deleted.

CR12156 10/26/61

See Figure 4. Ref. No. 9 of Mechanical Parts List. For 50 Cycle Operation Pulley is Sanborn No. 5P-17.

See Figure 6. Ref. No. 1. For 50 Cycle Operation Assembly, Thyrite and Choke is Sanborn No. 650-100-C20P1.

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
APRIL 6, 1962

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2D

SANBORN DIRECT WRITING OSCILLOGRAPH
MODEL 650

CR 12414 3/1/62

Sanborn Direct Writing Oscillograph Model 650 will have the following change:

2 magnets are added to the Lamp Housing and Timing Assembly 650-300-C9 (see fig. 14 in parts list).

Figure 14, reference no. 21: Drum Inner Timer; with the 2 magnets make Inner Drum Assembly 650-300-C15.

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
APRIL 30, 1962

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2E
SANBORN DIRECT-WRITING
OSCILLOGRAPHIC RECORDER
MODEL 650

CR12540 4/25/60 Schematic: 650-100-C1 Sub 6

Sanborn Direct-Writing Oscillographic Recorder, Model 650-100, stamped with CR12540 or higher will have the following changes:

Connector J26 is changed to a 12 pin female connector. Sanborn No. 10F12-1FX. Vendor Code RGK-12-31SL, Cannon Electric Co.

A wire is run from Resistor R1, Capacitor C1 junction to pin 12 of Connector J26. J26-12 is now +24 volts.

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
JULY 9, 1962

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2F
SANBORN DIRECT-WRITING
OSCILLOGRAPHIC RECORDER
MODEL 650-100

STANDARD CHANGE

RPL-650-100-2F

CR12707

Sanborn Ultraviolet Filter is added to improve static trace width characteristics. The following parts are added:

Glass Filter (Ultraviolet Transmitting). Sanborn Number 650-190

Filter Bracket. Sanborn Number 650-351

Filter Bracket Clip. Sanborn Number 650-352.

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
JULY 18, 1962

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2G
SANBORN DIRECT-WRITING
OSCILLOGRAPHIC RECORDER
MODEL 650

CR 12716 STANDARD CHANGE 7/12/62

Sanborn Direct-Writing Oscillographic Recorder, Model 650 will have the following change.

One of the post develope flourescent bulbs is changed for a black light flourescent lamp. Sanborn Number 30F-2. Vendor Code, FHT5/BLB, General Electric.

SANBORN COMPANY
175 WYMAN STREET
WALTHAM 54, MASS.
TEL: TW-4-6300
SEPTEMBER 4, 1962

REPLACEMENT PARTS LIST SUPPLEMENT
RPL-650-100-2H
SANBORN DIRECT-WRITING
OSCILLOGRAPHIC RECORDER
MODEL 650

CR12743 8/21/62

Sanborn Direct-Writing Oscillographic Recorder, Model 650 stamped with CR12743 or higher will have the following changes:

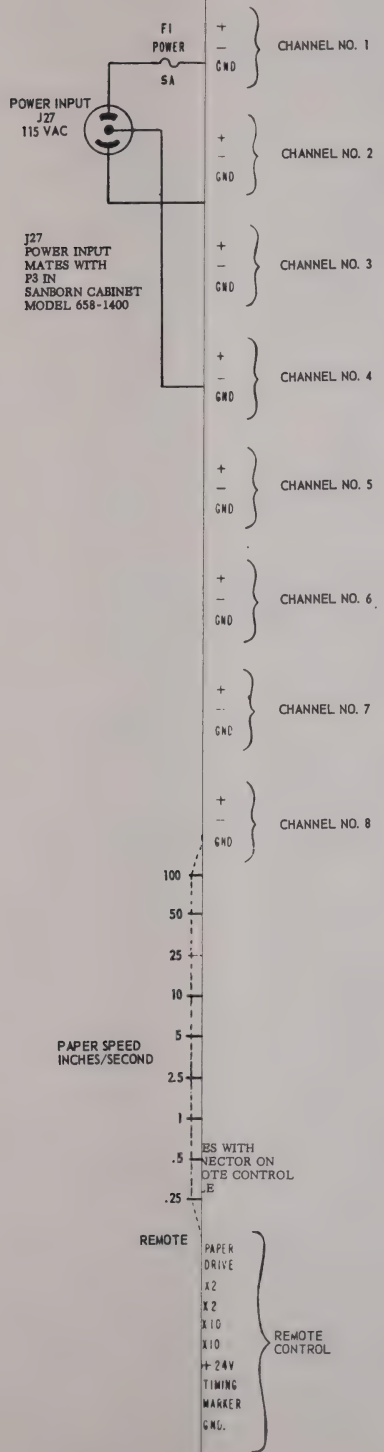
The white wire from the brake solenoid #6 is connected to terminal 1 of switch S7.

The white, brown, black wire of cable is connected to terminal 2 of switch S7.

The white, red, yellow wire of the cable is connected to terminal 3.

The blue wire of cable is connected to terminal 4 of switch S7.

A jumper is connected from terminal 1 to terminal 2 of switch S7.



NOTES:

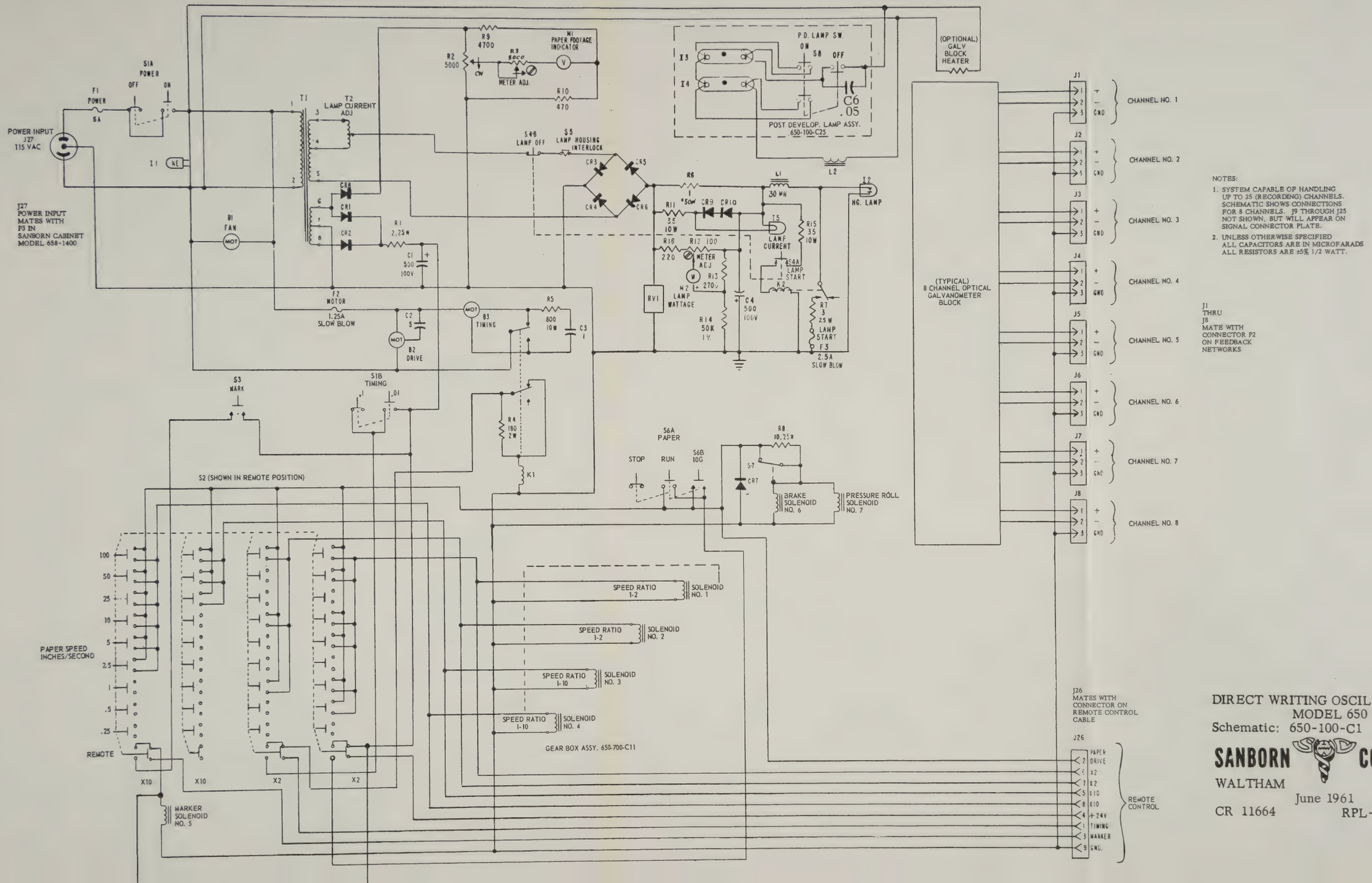
1. SYSTEM CAPABLE OF HANDLING UP TO 25 (RECORDING) CHANNELS. SCHEMATIC SHOWS CONNECTIONS FOR 8 CHANNELS. J9 THROUGH J25 NOT SHOWN, BUT WILL APPEAR ON SIGNAL CONNECTOR PLATE.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS ALL RESISTORS ARE ±5% 1/2 WATT.

DIRECT WRITING OSCILLOGRAPH
MODEL 650
Schematic: 650-100-C1 SUB 3

SANBORN COMPANY
WALTHAM MASS.

June 1961

CR 11664 RPL-650-100-2



DIRECT WRITING OSCILLOGRAPH
MODEL 650
Schematic: 650-100-C1 SUB 3

SANBORN COMPANY
WALTHAM MASS.

June 1961
CR 11664 RPL-650-100-2

: Switch	62C-10	SM(ACRO)
ch 4 Button	62P-4	(SAN)
ch 10-Button	62P-8	(SAN)
ch 1-Button	62P-4	170(OAK)
ch 2-Button	62P-7	(SAN)
: Switch	62C-10	SM(ACRO)
: Switch	62C-10	SM(ACRO)
Push Switch Act.	62P-5	(SAN)
: Switch	62C-10	SM(ACRO)
: Switch	62C-10	SM(ACRO)
Fluorescent Lamp Switch	62A-17	A209(STOC)
	62RC-1	(SAN)
.ay	62R-30	(SAN)
Brake	61R-2	(SAN)
Pressure Roll	61R-3	(SAN)
mer, Power	66B-135	(SAN)
mer, Variable	66V-2	M-5(GR)

VIATIONS

lley

:miconductor Inc.

ubilier

'elephone Supply Co.
ucts

Cullough Inc.

lectric
adio

nal Instrument Inc.
nal Resistance Corp.

mfield Inc.

o.
arzian

Yale

trument

ACCESSORIES

AMT.	DESCRIPTION	SANBORN NO.
*1 per channel	3-pin Female Connector	10F3-3FW
1	9-pin Male Connector	10F9-1MW
*1	Power Cord Assembly	154-1100-C19
*1	3-contact Adapter Plug (AC)	10G3-11MFW
1	2.5 amp. Slow Blow Fuse	26B-10
1	5 amp. Fuse	26B-12
1	1.25 amp. Slow Blow Fuse	26B-14
1	Print Out Paper (200')	3A-15
1	Screwdriver	37A-10A
1	Adjusting Tool	25A-46
1	Extractor Galvanometer	25B-1
as ord.	Print Out Paper (350'), very thin	3A-16
as ord.	Lamp, Mercury Arc	30M-2

* Supplied only when unit is not part of a system.

CHANGES:

CR 11394	Added Capacitor Symbol C5 .1 Mfd 200V on S2	1/27/61
CR 11467	Lamp & Meter Circuit Changed	2/21/61
CR 11664	Added Capacitor C6	4/28/61

LOGRAPHIC RECORDER MODEL 650-100 (FRONT VIEW).

		SANBORN NO.	T.Q.	R.S.	VENDOR NO.
14	-32 x 3/8	80A-832-6G	4		
	s	5P-7	1	1	
		59E-1	1	1	
	g	650-642	1	1	
	long	83A-6-12B	2		
	long	83A-632-8B	1	3	
		4S-5	1	1	
		- -	1		
		- -	1		
		650-600-C5	1	2	
		650-180	2	1	
	bly (Right)	650-100-C15	1		
	g	83A-4-4B	1		
	bly	650-600-C11	1	1	
	00 ohm (R2)	56S-20	1	1	
	dicator	650-639	1		
	8 long	81D-440-2B	2		
		824-35	1		
13	ollower Assembly	650-600-C10	1		
12	r Brake)	650-637	1		
	ver	650-638	1		
	ht)	650-600-C8	1	1	
11	t)	650-600-C9	1	1	
	Assembly	650-100-C16	1		
	Motor	650-184	1		
	Motor	650-152	1		
	(See Figure 10)	650-600-C4	1	1	
	g	83A-8-5B	6		

SYMBOL	DESCRIPTION	SANBORN NO.	VENDOR CODE
B1	Muffin Fan	38F-9	(ROT)
B2	Driver Motor	38B-45	(SAN)
B3	Motor (Timing Generator)	38B-47	(SAN)
CR1 thru CR6	Silicon Rectifier	16A-46	1N2148(BSC)
CR7	Silicon Rectifier	16A-48	10JB3(SAR)
CR8	Germanium Diode	16A-16	1N91(GE)
CR9	Selenium Rectifier	16A-39	1N2069(TEX)
CR10	Selenium Rectifier	16A-39	1N2069(TEX)
C1	500 Mfd 100 VDCW	8C-71	32D-2166K(SPR)
C2	5 Mfd 330VAC	8B-126	P150F214(AERO)
C3	1 Mfd Capacitor	8B-128	VC2026(CD)
C4	500 Mfd 100VDCW	8C-71	32D-2166K(SPR)
C5	.1 Mfd 200V	8B-66	WMF(CD)
C6	.05 Mfd 500V	8E-29	36C142A (SPR)
F1	5 Amp Fuse	26B-12	312005 (LIT)
F2	1.25 Amp Slow Blow	26B-14	MDL (FUSE)
F3	2.5 Amp. Slow Blow Fuse	26B-10	MDL (BUSS)
I1	Neon Lamp	30B-1	NE-51(GE)
I2	Mercury Arc Lamp	30M-2	(SAN)
I3	Fluorescent Lamp (Post Developing)	30F-1	F4T5/CW(SYL)
I4	Fluorescent Lamp (Post Developing)	30F-1	F4T5/CW(SYL)
I5	Lamp 1.35V, .06 Amp.	30A-22	39-1.35-1432(DIAL)
J1 thru J8	3-Pin Male Connector	10F3-3MX	XLR-3-32(CAN)
J26	9-Pin Female Connector	10F9-1FX	RGK-9-31SL(CAN)
J27	3-Pin Male AC Receptacle	10G3-9MX	7486G(GRA)
K1	Relay, Vacuum Switch	62R-37	GA11D(POT)
K2	DPDT 24VDC	62R-34	VS-2(EMC)
L1	Triggering Coil	66B-92	(SAN)
L2	Lamp Choke	66C-13	A-780(STOC)
M1	Footage Indicator	36A-13	1120(III)
M2	0-1MA Watt Meter	36A-17	(SAN)
R1	2 ohm 10% 25W	53A-2RKA	B25(DALE)
R2	5000 ohm pot.	56S-20	Series 65(CTSC)
R3	5000 ohm pot.	56A-49	#37T(CLA)
R4	180 ohm 5% 2W comp.	52C-181J	HB(AB)
R5	800 ohm 10% 10W	53A-801K	Type 1 3/4A(IRC)
R6	1 ohm 10% 50W	53A-1RKA	Dalohm B50(DALE)
R7	3 ohm 10% 25W	53A-3RKA	B25(DALE)
R8	10 ohm 10% 25W	53A-100K	B25(DALE)
R9	4700 ohm 5% 1/2W comp.	50AB-472J	EB(AB)
R10	470 ohm 5% 1/2W comp.	50AB-471J	EB(AB)
R11	35 Ohm ±10% 10W WW	53A-350K	1 3/4A(IRC)
R12	100 Ohm Pot.	56A-89	#43T(CLA)
R13	2700 Ohm ±5% 1/2W	50AB-272J	EB(AB)
R14	50K Ohm ±1% 1/2W	50H-503G	N11(WEL)
R15	35 Ohm ±10% 10W WW	53A-350K	1 3/4A(IRC)
R16	220 Ohm ±5% 1/2W	50AB-221J	EB(AB)
RV1	Thyrite Resistor	56T-5	V-3900353(GE)
S1A	Miniature Switch	62C-10	SM(ACRO)
S1B	Push Switch 4 Button	62P-4	(SAN)
S2	Push Switch 10-Button	62P-8	(SAN)
S3	Push Switch 1-Button	62P-4	170(OAK)
S4A	Push Switch 2-Button	62P-7	(SAN)
S4B	Miniature Switch	62C-10	SM(ACRO)
S5	Miniature Switch	62C-10	SM(ACRO)
S6A	3-Button Push Switch Act.	62P-5	(SAN)
S6B	Miniature Switch	62C-10	SM(ACRO)
S7	Miniature Switch	62C-10	SM(ACRO)
S8	2-Button Fluorescent Lamp Switch	62A-17	A209(STOC)
SOL1 thru SOL4	Solenoid	62RC-1	(SAN)
SOL5	Coil, Relay	62R-30	(SAN)
SOL6	Solenoid, Brake	61R-2	(SAN)
SOL7	Solenoid, Pressure Roll	61R-3	(SAN)
T1	Transformer, Power	66B-135	(SAN)
T2	Transformer, Variable	66V-2	M-5(GR)

VENDOR ABBREVIATIONS

AB	Allen Bradley
ACRO	Acro
AERO	Aerovox
BSC	Bradley Semiconductor Inc.
BUS	Bussman
CAN	Cannon
CD	Cornell Dubilier
CLA	Clarostat
CTSC	Chicago Telephone Supply Co.
DALE	Dale Products
DIAL	Dialight
EMC	Eital-McCullough Inc.
FUSE	Fusetron
GE	General Electric
GR	General Radio
GRA	Graybar
III	International Instrument Inc.
IRC	International Resistance Corp.
LIT	Littlefuse
OAK	Oak
POT	Potter Brumfield Inc.
ROT	Rotron
SAN	Sanborn Co.
SAR	Sarkes-Tarzian
SPR	Sprague
STOC	Stocker & Yale
SYL	Sylvania
TEX	Texas Instrument
WEL	Welwyn

ACCESSORIES

AMT.	DESCRIPTION	SANBORN NO.
*1 per channel	3-pin Female Connector	10F3-3FW
1	9-pin Male Connector	10F9-1MW
*1	Power Cord Assembly	154-1100-C19
*1	3-contact Adapter Plug (AC)	10G3-11MFW
1	2.5 amp. Slow Blow Fuse	26B-10
1	5 amp. Fuse	26B-12
1	1.25 amp. Slow Blow Fuse	26B-14
1	Print Out Paper (200')	3A-15
1	Screwdriver	37A-10A
1	Adjusting Tool	25A-46
1	Extractor Galvanometer	25B-1
as ord.	Print Out Paper (350'), very thin	3A-16
as ord.	Lamp, Mercury Arc	30M-2

* Supplied only when unit is not part of a system.

CHANGES:

CR 11394	Added Capacitor Symbol C5 .1 Mfd 200V on S2	1/27/61
CR 11467	Lamp & Meter Circuit Changed	2/21/61
CR 11664	Added Capacitor C6	4/28/61

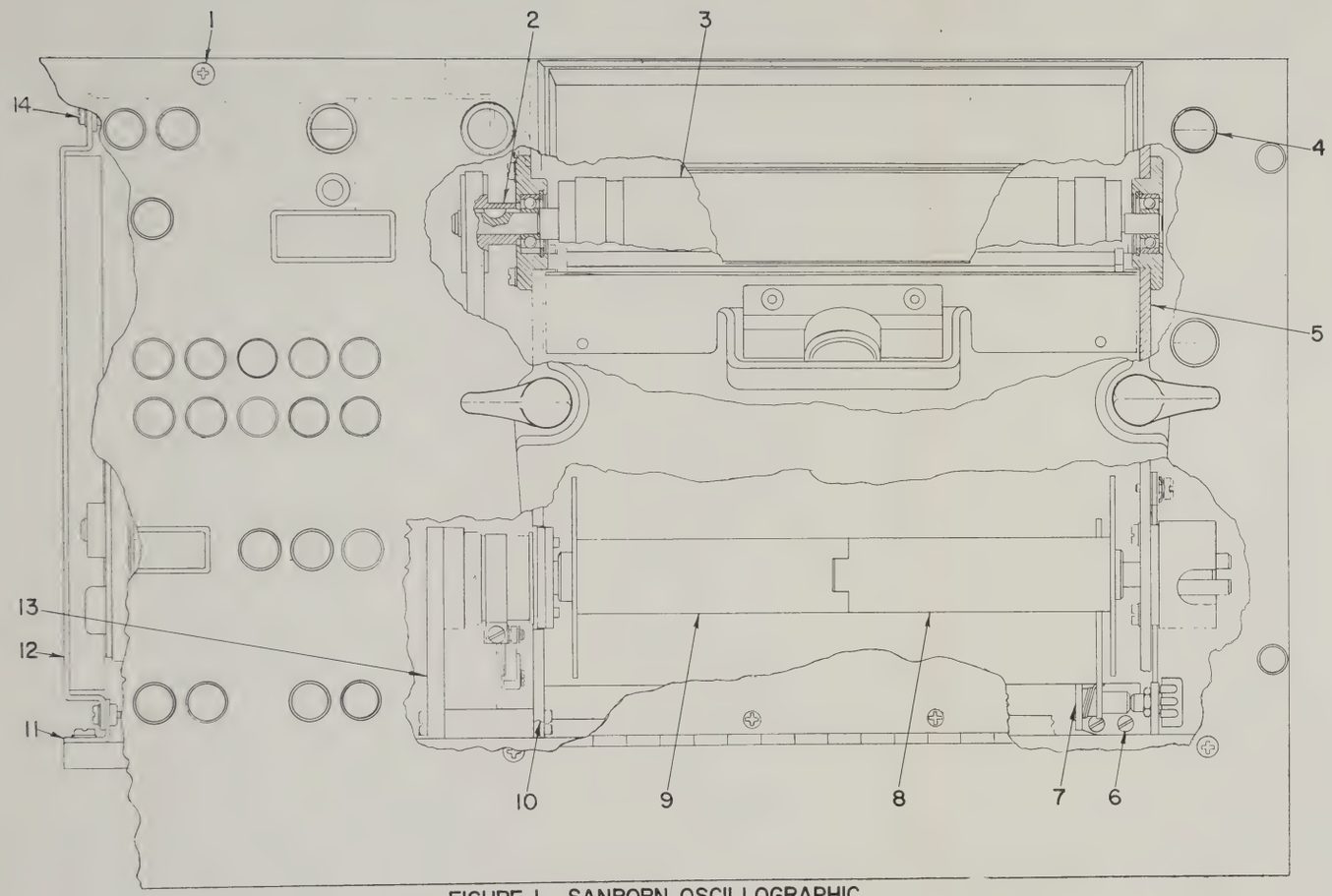


FIGURE 1. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 FRONT VIEW

Figure 1. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (FRONT VIEW).

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Screw, Phillips Hd. 8-32 x 3/8	80A-832-6G	4		
2	Pulley Assembly consisting of:				
	Pulley, 22 grooves	5P-7	1	1	
	Key, Woodruff	59E-1	1	1	
	Retainer, Bearing	650-642	1	1	
	Sems, 6-32 x 3/4 long	83A-6-12B	2		
	Sems, 6-32 x 1/2 long	83A-632-8B	1	3	
	Bearing, Ball	4S-5	1	1	
	Ring, Retainer	- -	1		
	Ring, Grip	- -	1		
3	Drive Roll Assembly	650-600-C5	1	2	
4	Knob, Grid Trim	650-180	2	1	
5	Recorder Plate Assembly (Right) (See Figure 6)	650-100-C15	1		
6	Sems, 4-40 x 1/4 long	83A-4-4B	1		
7	Paper Indicator Assembly consisting of:	650-600-C11	1	1	
	Potentiometer, 5000 ohm (R2)	56S-20	1	1	
	Bracket, Paper Indicator	650-639	1		
	Set Screw 4-40 1/8 long	81D-440-2B	2		
	Spring	824-35	1		
	Paper Indicator Follower Assembly consisting of:	650-600-C10	1		
	Follower (Paper Brake)	650-637	1		
	Spacer, Follower	650-638	1		
8	Spindle Assembly (Right)	650-600-C8	1	1	
9	Spindle Assembly (Left)	650-600-C9	1	1	
10	Recorder Center Plate Assembly (See Figure 9)	650-100-C16	1		
11	Bracket, Gear Box and Motor	650-184	1		
12	Cover, Gear Box and Motor	650-152	1		
13	Paper Brake Assembly (See Figure 10)	650-600-C4	1	1	
14	Sems, 8-32 x 5/16 long	83A-8-5B	6		

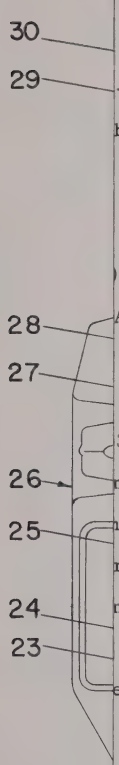
T.Q. Total Quantity per assembly

R.S. Recommended Spares one year operation

Figure 2. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (TOP VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Belt, Beam Interrupter	650-117	1	2	
	Interrupter, Beam	650-129	2	2	
2	Screw, Fl. Hd. 8-32 x 1/4 long	80A-832-4D	2		
3	Bezel, Viewing Screen	650-153	1		
4	Knob, Variac	32A-47	1	1	
	Bushing, Lens Adj. (Variac)	650-132	1		
	Nut, Lens Adj. (Variac)	650-325	1		
5	"O" Ring (5-1/8 x 1/8)	77A-50	1	4	

LLOGRAPHIC RECORDER MODEL 650-100 (RIGHT SIDE VIEW)



	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
	650-179	1		
	62B-88A	2		
g	83A-4-4B			
	650-112	1		
	650-131	2		
	650-133	1		
	650-134	1		
-40 x 9/16 long	80A-440-9B	4		
bly (Intensity Control)	650-300-C6	1		
	650-150	1		
	650-106	1		
) x 1/4 long	80A-440-4D	8		
Access	650-161	2		
	650-121	1		
	9B-1A	8		
32	838-7	8		
ntury)	9A-3	1		
nting	650-164	1		
r Support	650-110	1		
ng	83A-10-8B	5		
	650-115	1		
ete Assembly	650-300-C10	1		
	650-116	1		
ssembly	650-300-C11	1		
ing	650-307	1		
	75A-46A	2		
	75A-39A	2		
ssembly	650-600-C7			
dle)	650-624	1		
Spindle)	650-632	1		
	62B-88B	1		
ly (See Figure 15)	650-600-C6	1		
	44J-4-48	1		
r Loading) (See Figure 16)	650-600-C3	1		
nd Marker)	650-136	1		
and Marker)	650-137	1		
	650-128	1		
g	83A-8-6B	1		
ng	83A-6-7B	1		

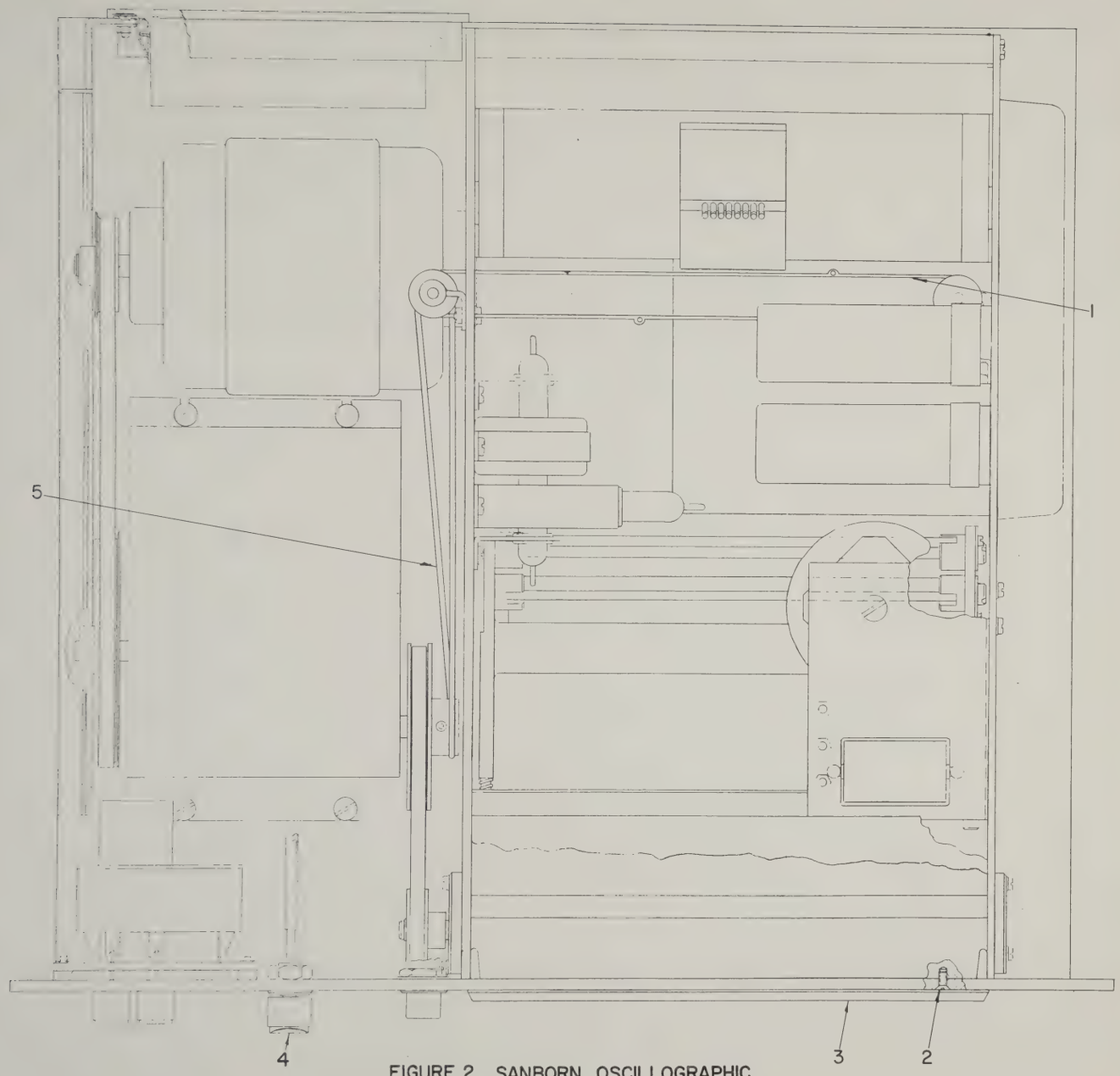


FIGURE 2. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 TOP VIEW

Figure 2. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (TOP VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S. VENDOR NO.
1	Belt, Beam Interrupter	650-117	1	2
	Interrupter, Beam	650-129	2	2
2	Screw, Fl. Hd. 8-32 x 1/4 long	80A-832-4D	2	
3	Bezel, Viewing Screen	650-153	1	
4	Knob, Variac	32A-47	1	1
	Bushing, Lens Adj. (Variac)	650-132	1	
	Nut, Lens Adj. (Variac)	650-325	1	
5	"O" Ring (5-1/8 x 1/8)	77A-50	1	4

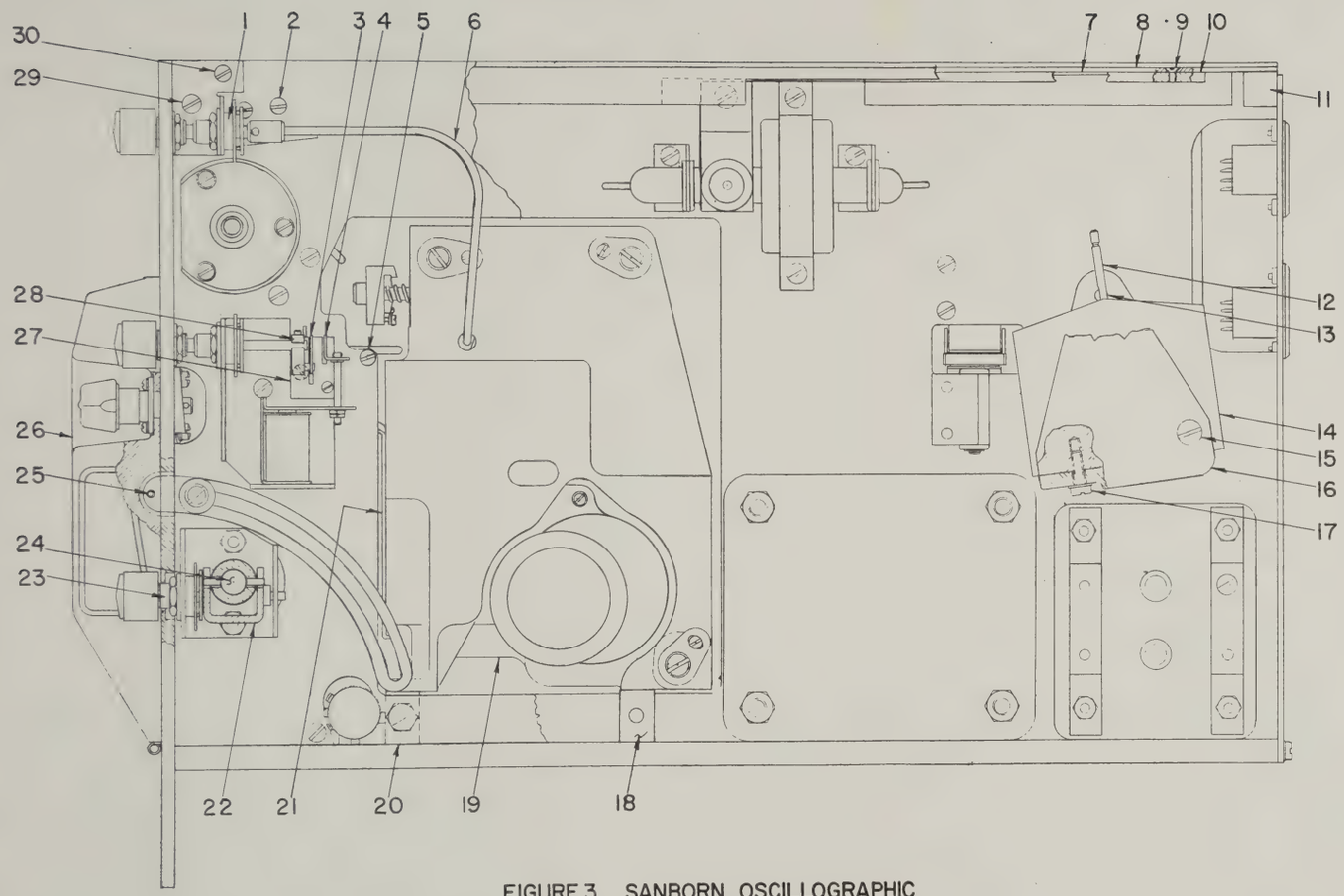


FIGURE 3. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 RIGHT SIDE VIEW

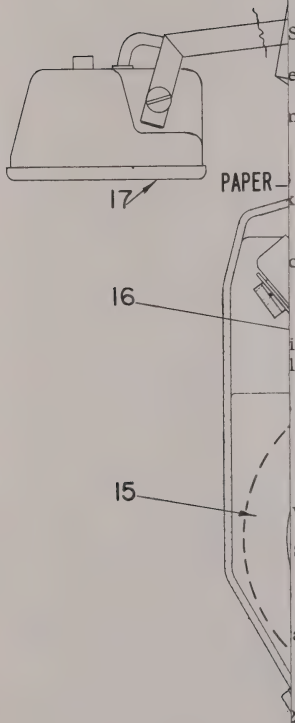
Figure 3. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (RIGHT SIDE VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S. VENDOR NO.
1	Bracket, Trim Switch	650-179	1	
	Detent, 4-position	62B-88A	2	
2	Sems, 4-40 x 1/4 long	83A-4-4B		
3	Trim, Grid	650-112	1	
	Pin, Grid Marker	650-131	2	
4	Arm, Marker	650-133	1	
	Rod, Marker	650-134	1	
5	Screw, Binding Hd. 4-40 x 9/16 long	80A-440-9B	4	
6	Flexible Shaft Assembly (Intensity Control) (See Figure 12)	650-300-C6	1	
7	Door (Top Plate)	650-150	1	
8	Plate, Recorder Top	650-106	1	
9	Screw, Flat Hd. 4-40 x 1/4 long	80A-440-4D	8	
10	Slide, Galvanometer Access	650-161	2	
11	Spacer, Upper Rear	650-121	1	
12	Galvanometer	9B-1A	8	
13	Screw, Shoulder, 10-32	838-7	8	
14	Magnet Structure (Century)	9A-3	1	
15	Bracket, Variac Mounting	650-164	1	
16	Cradle, Galvanometer Support	650-110	1	
17	Sems, 10-32,x 1/2 long	83A-10-8B	5	
18	Spacer, Rear	650-115	1	
19	Lamp Housing Complete Assembly (See Figure 13)	650-300-C10	1	
20	Spacer, Front	650-116	1	
21	Lamp Housing Door Assembly consisting of:	650-300-C11	1	
	Door Lamp Housing	650-307	1	
	Stud Fastener	75A-46A	2	
	Retainer Ring	75A-39A	2	
22	Yoke Paper Spindle Assembly consisting of:	650-600-C7		
	Yoke (Paper Spindle)	650-624	1	
	Pivot (Yoke Paper Spindle)	650-632	1	
23	Detent, 2-position	62B-88B	1	
24	Paper Spindle Assembly (See Figure 15)	650-600-C6	1	
25	Roll Pin, 1/16 x 3/4	44J-4-48	1	
26	Door Assembly (Paper Loading) (See Figure 16)	650-600-C3	1	
27	Support, Left (Grid and Marker)	650-136	1	
	Support, Right (Grid and Marker)	650-137	1	
28	Arm, Grid Trim	650-128	1	
29	Sems, 8-32 x 3/8 long	83A-8-6B	1	
30	Sems, 6-32 x 7/16 long	83A-6-7B	1	

Figure 4. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (LEFT SIDE VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Sems, 8-32 x 1/4 long	83A-8-4B	4		
2	Sems, 10-32 x 3/8 long	83A-1032-6B	7		
3	Bracket, Variac Mounting	650-164	1		
4	Variac Adjust Assembly (See Figure 20)	650-100-C23	1		
5	Chassis Upper Assembly (See Figure 21)	650-100-C10	1		
6	Panel Assembly (See Figure 23)	650-100-C7	1		
7	Knob, Push Button	32A-55	20	1	
8	Belt, Timing 17"	77G-1	1	1	
9	Pulley, 44 grooves	5P-6	1	1	
10	Sems, 10-32 x 1/2 long	83A-10-8B	5		
11	Gear Box Assembly (See Figure 29)	650-700-C11	1	1	
12	Pulley, 60 grooves	5P-12	1	1	
13	Belt, Timing 22"	77G-2	1	1	
14	Pulley, 25 grooves	5P-11	1	1	
15	Base, Recorder Bottom	650-105	1		
16	Screw, Hex. Hd. 12-24 x 3/8 long	80A-1224-6V	3		
17	Motor, Drive	38B-45	1	1	(SAN)
18	Rear Recorder Plate Assembly (See Figure 34)	650-100-C14	1		

SCILLOGRAPHIC RECORDER MODEL 650-100 (RIGHT SIDE, SECTIONAL VIEW)



PTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
	650-623	1		
long	83A-4-2B	5		
Screen	650-108	1		
embly	650-100-C26	2		
n (machining)	650-175	1		
	40L-4	2		
long	83A-4-2B	5		
1/8 long	81A-632B	2		
	650-109	1	1	
creen	650-167	1		
	650-114	1		
im	650-339	1		
long	83A-4-4B	7		
long	83A-2-6B	1		
	- -	4		
(Midwest)	9B-8	1	1	
vanometer	650-160	1		
8 long	83A-10-14B	2		
long	83A-8-10B	2		
adle	650-612	1		
	650-111	1		
200 ft.)	3A-15			
300 ft.)	3A-16			
long	83A-2-2B	2		
ort	650-130	1		
")	650-177	1	2	
er Assembly	650-100-C25	1		

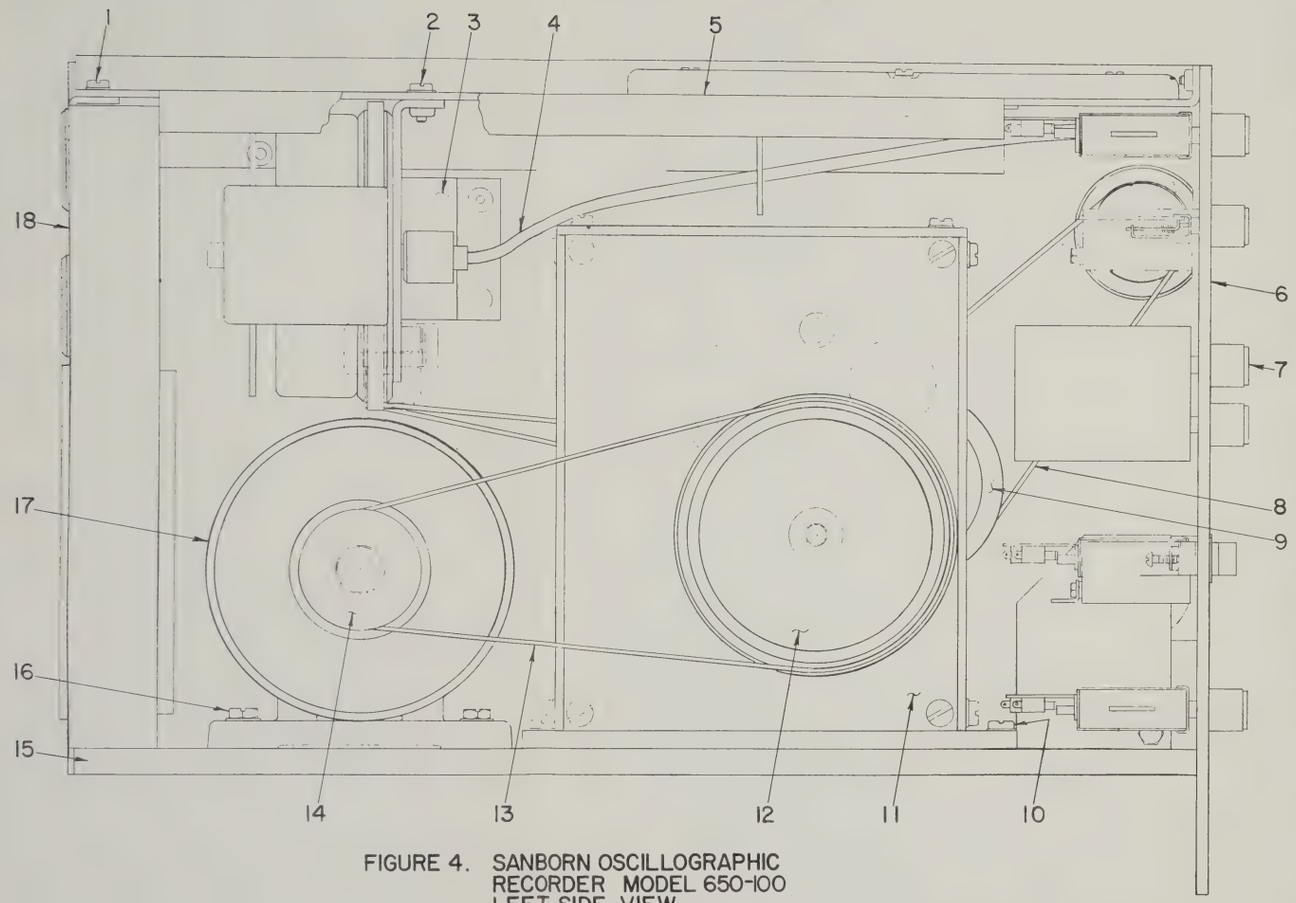


FIGURE 4. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 LEFT SIDE VIEW

Figure 4. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (LEFT SIDE VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Sems, 8-32 x 1/4 long	83A-8-4B	4		
2	Sems, 10-32 x 3/8 long	83A-1032-6B	7		
3	Bracket, Variac Mounting	650-164	1		
4	Variac Adjust Assembly (See Figure 20)	650-100-C23	1		
5	Chassis Upper Assembly (See Figure 21)	650-100-C10	1		
6	Panel Assembly (See Figure 23)	650-100-C7	1		
7	Knob, Push Button	32A-55	20	1	
8	Belt, Timing 17"	77G-1	1	1	
9	Pulley, 44 grooves	5P-6	1	1	
10	Sems, 10-32 x 1/2 long	83A-10-8B	5		
11	Gear Box Assembly (See Figure 29)	650-700-C11	1	1	
12	Pulley, 60 grooves	5P-12	1	1	
13	Belt, Timing 22"	77G-2	1	1	
14	Pulley, 25 grooves	5P-11	1	1	
15	Base, Recorder Bottom	650-105	1		
16	Screw, Hex. Hd. 12-24 x 3/8 long	80A-1224-6V	3		
17	Motor, Drive	38B-45	1	1	(SAN)
18	Rear Recorder Plate Assembly (See Figure 34)	650-100-C14	1		

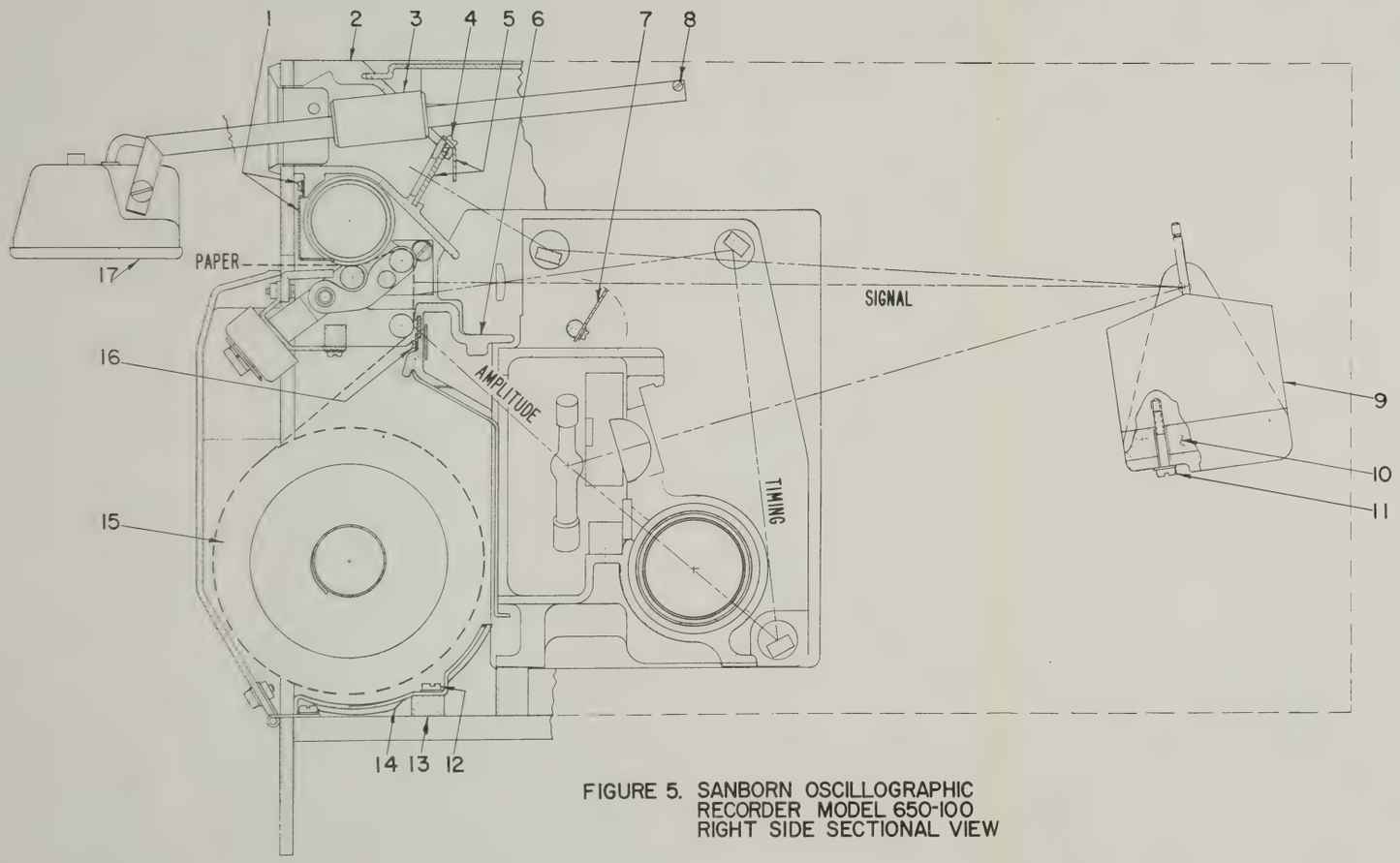


FIGURE 5. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 RIGHT SIDE SECTIONAL VIEW

Figure 5. SANBORN OSCILLOGRAPHIC RECORDER MODEL 650-100 (RIGHT SIDE, SECTIONAL VIEW)

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Guide, Paper	650-623	1		
	Sems, 4-40 x 1/8 long	83A-4-2B	5		
2	Holder, Viewing Screen	650-108	1		
3	Support Arm Assembly consisting of:	650-100-C26	2		
	Support, Arm (machining)	650-175	1		
	Insert, 4-40	40L-4	2		
4	Sems, 4-40 x 1/8 long	83A-4-2B	5		
	Screw, Set 6-32 x 1/8 long	81A-632B	2		
5	Viewing, Screen	650-109	1	1	
	Baffle, Viewing Screen	650-167	1		
6	Support, Grid	650-114	1		
7	Light Internal Trim	650-339	1		
	Sems 4-40 x 1/4 long	83A-4-4B	7		
8	Sems, 2-56 x 3/8 long	83A-2-6B	1		
	Nut, 2-56	- -	4		
9	Magnet Structure (Midwest)	9B-8	1	1	
10	Spacer, Plate Galvanometer	650-160	1		
11	Sems, 10-32 x 7/8 long	83A-10-14B	2		
12	Sems, 8-32 x 5/8 long	83A-8-10B	2		
13	Spacer, Paper Cradle	650-612	1		
14	Cradle, Paper	650-111	1		
15	Print Out Paper (200 ft.)	3A-15			
	Print Out Paper (300 ft.)	3A-16			
16	Sems, 2-56 x 1/8 long	83A-2-2B	2		
	Strap, Grid Support	650-130	1		
	Grid, Mach. (0.1")	650-177	1	2	
17	Reflector and Cover Assembly (See Figure 35)	650-100-C25	1		

Figure 6. RECORDER PLATE ASSEMBLY (RIGHT) MODEL 650-100-C15.

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Thyrite & Choke Assembly (See Figure 7)	650-100-C20	1	1	
	Sem 6-32 x 7/16	83A-6-7B	3		
2	Capacitor 500 mfd 100V (C1, C4)	8C-71	2	2	32D-2166K(SPR)
	Bracket, Choke Mounting	650-123	2		
	Lug #10	34A-15	4		
	Sem 6-32 x 1/4 long	83A-6-4B	4		
3	Transformer, Power (T1)	66B-135	1	1	(SAN)
	Washer, Lock	73A-114	4		
	Nut, Hex 1/4-20	- -	4		
4	Coil, Triggering (L1)	66B-92	1	1	(SAN)
	Sems 10-32 x 7/16	83A-10-7B	4		
	Bracket, Choke Mounting	650-123	2		
	Washer, Lock	73A-8	4		
	Nut, Hex 8-32	- -	4		
5	Pulley Shaft & Bracket Assembly (Short Beam Interrupter) (See Figure 8)	650-100-C8	1		
	Sem 6-32 x 7/16	83A-6-7B	2		
6	Retainer, Bearing	650-642	1		
	Sems 6-32 x 5/8 long	83A-6-5B	2		
	Sem 6-32 x 7/16	83A-6-7B	7		
7	Locating Plate (Idler Roll)	650-628	1		
	Sems 4-40 x 5/16 long	83A-4-5B	7		
8	Spacer, Cover	650-151	1		
9	Resistor, 2 ohm 25W (R1)	53A-2RKA	1	1	B25(DAL)
10	Spacer Cover	650-151	1		
11	Nylon Channel 2-5/16 long	NY-156	1		
12	Diodes, BY402 (CR1 thru CR6)	16A-46	6	12	1N2148(BSC)
13	Standoff, insulated (E8, E9, E11, E12, E16)	34E-1	5	5	
14	Resistor 1 ohm 50W (R6)	53A-1RKA	1	1	(DAL)
	Sems 4-40 x 1/4 long	83A-4-4B	2		
15	Spacer, Cover	650-151	1		
16	Plate, Recorder (Right)	650-104	1		
17	Slide, Loading Door	650-147	1		
	Washer, Nylon	710N-10	1		
	Washer, Flat Spring	74G-10	1		
	Screw, Shoulder	838-10	1		

MODEL 650-100-C20

SANBORN NO.	T.Q.	R.S.	VENDOR NO.
650-186	1		
20A-4	1		
650-176	1		
80A-1420-16A	1		
71A-1/4-34	1		
- -	1		
650-157	2		
650-156	2		
56T-5	2	2	V3900353(GE)
83A-2-3B	2		
34A-1	2		
34E-1	3		
83A-4-4B	3		
74A-4A	3		
83A-4-12B	3		
650-186	1		
700-8035-12	3		
66-13	1	4	A-780(STOC)
40T-4	1		

SSEMBLY (SHORT BEAM INTERRUPTER)

SANBORN NO.	T.Q.	R.S.	VENDOR NO.
650-124	1		
5A-11A	2	1	
650-100-C3	1		
650-138	1		
650-141	1	1	
59C-2	1		

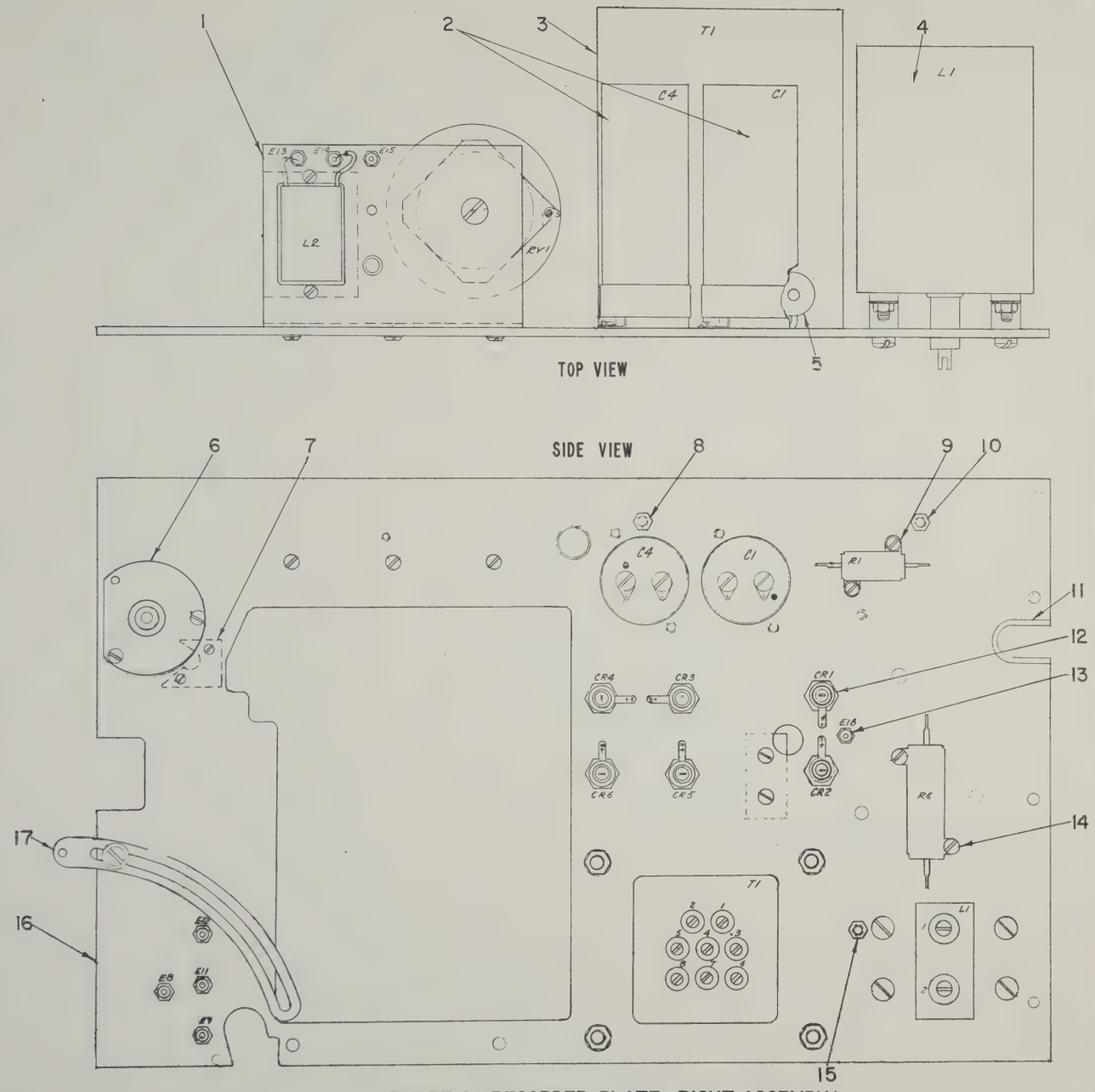


FIGURE 6. RECORDER PLATE , RIGHT, ASSEMBLY

Figure 6. RECORDER PLATE ASSEMBLY (RIGHT) MODEL 650-100-C15.

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Thyrite & Choke Assembly (See Figure 7)	650-100-C20	1	1	
	Sem 6-32 x 7/16	83A-6-7B	3		
2	Capacitor 500 mfd 100V (C1, C4)	8C-71	2	2	32D-2166K(SPR)
	Bracket, Choke Mounting	650-123	2		
	Lug #10	34A-15	4		
	Sem 6-32 x 1/4 long	83A-6-4B	4		
3	Transformer, Power (T1)	66B-135	1	1	(SAN)
	Washer, Lock	73A-114	4		
	Nut, Hex 1/4-20	- -	4		
4	Coil, Triggering (L1)	66B-92	1	1	(SAN)
	Sems 10-32 x 7/16	83A-10-7B	4		
	Bracket, Choke Mounting	650-123	2		
	Washer,Lock	73A-8	4		
	Nut, Hex 8-32	- -	4		
5	Pulley Shaft & Bracket Assembly (Short Beam Interrupter) (See Figure 8)	650-100-C8	1		
	Sem 6-32 x 7/16	83A-6-7B	2		
6	Retainer, Bearing	650-642	1		
	Sems 6-32 x 5/8 long	83A-6-5B	2		
	Sem 6-32 x 7/16	83A-6-7B	7		
7	Locating Plate (Idler Roll)	650-628	1		
	Sems 4-40 x 5/16 long	83A-4-5B	7		
8	Spacer, Cover	650-151	1		
9	Resistor, 2 ohm 25W (R1)	53A-2RKA	1	1	B25(DAL)
10	Spacer Cover	650-151	1		
11	Nylon Channel 2-5/16 long	NY-156	1		
12	Diodes, BY402 (CR1 thru CR6)	16A-46	6	12	1N2148(BSC)
13	Standoff, insulated (E8, E9, E11, E12, E16)	34E-1	5	5	
14	Resistor 1 ohm 50W (R6)	53A-1RKA	1	1	(DAL)
	Sems 4-40 x 1/4 long	83A-4-4B	2		
15	Spacer, Cover	650-151	1		
16	Plate, Recorder (Right)	650-104	1		
17	Slide, Loading Door	650-147	1		
	Washer, Nylon	710N-10	1		
	Washer, Flat Spring	74G-10	1		
	Screw, Shoulder	838-10	1		

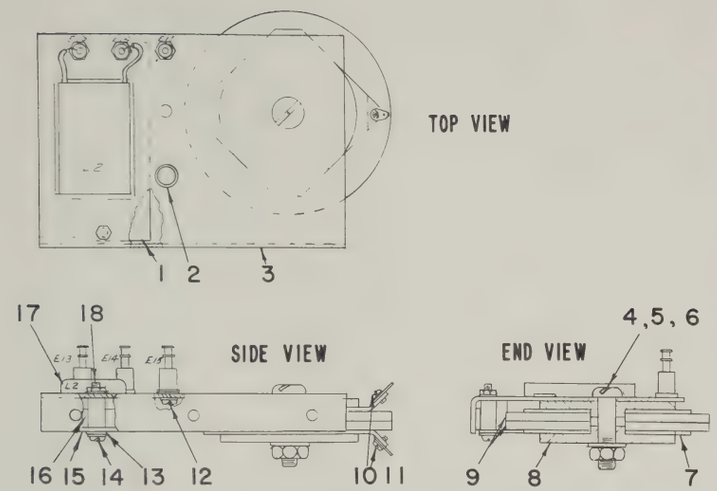


FIGURE 7. THYRITE AND CHOKE ASSEMBLY

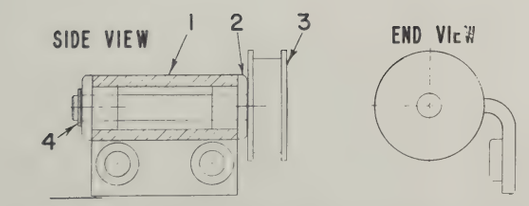


FIGURE 8. PULLEY SHAFT AND BRACKET (SHORT) BEAM INTERRUPTER) ASSEMBLY

Figure 7. THYRITE AND CHOKE ASSEMBLY MODEL 650-100-C20

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Bracket, Choke	650-186	1		
2	Eyelet	20A-4	1		
3	Bracket, Thyrite and Choke	650-176	1		
4	Screw R.D. Hd. Brass 1/4-20 x 1 long	80A-1420-16A	1		
5	Lockwasher 1/4"	71A-1/4-34	1		
6	Nut, Hex 1/4 - 20	- -	1		
7	Plate, Thyrite	650-157	2		
8	Washer, Shoulder	650-156	2		
9	Resistor, Thyrite (RV1, RV2)	56T-5	2	2	V3900353(GE)
10	Sems 2-56 x 3-16 long	83A-2-3B	2		
11	Lug	34A-1	2		
12	Standoff (E13, E14, E15) Sems 4-40 x 1/4 long	34E-1 83A-4-4B	3 3		
13	Washer #4 Flat Brass	74A-4A	3		
14	Sems 4-40 x 3/4 long	83A-4-12B	3		
15	Bracket, Choke	650-186	1		
16	Spacer	700-8035-12	3		
17	Choke Lamp (L2)	66-13	1	4	A-780(STOC)
18	Nut Kep	40T-4	1		

Figure 8. PULLEY SHAFT AND BRACKET ASSEMBLY (SHORT BEAM INTERRUPTER) MODEL 650-100-C8.

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Bracket (Short)	650-124	1		
2	Bearing (Oilite)	5A-11A	2	1	
3	Pulley Shaft Assembly (Short) consisting of:	650-100-C3	1		
	Shaft (short)	650-138	1		
	Pulley	650-141	1	1	
4	Grip Ring	59C-2	1		

Figure 9. RECORDER CENTER PLATE ASSEMBLY MODEL 650-100-C16

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Paper Brake Assembly (See Figure 10)	650-600-C4	1		
2	Support, Left (Marker)	650-136	1		
3	Sems 4-40 x 7/16	83A-4-7B	1		
4	Dual Pulley and Bracket Assembly (See Figure 11)	650-100-C9	1		
5	Sems 4-40 x 3/8 long	83A-4-6B	6		
6	Locating Plate (Idler Roll)	650-628	1		
	Sems 8-32 x 5/16	83A-8-5B	2		
7	Coil, Vacuum Switch (K2)	62R-34	1	2	VS-2(EMC)
	Sems 6-32 x 5/16-1/4	83A-6-4B	1		
	Bracket, Vacuum Switch Coil	801-62P1	2		
	Sems 6-32 x 5/16 long	83A-6-5B	2		
8	Sems 6-32 x 5/16 long	83A-6-5B	1		
9	Bracket Vacuum Switch	650-140	1		
10	Grommet, Rubber	77A-23	1		
11	Standoff, insulated (E2, E3, E4, E5)	34E-1	4		
12	Resistor 3 ohm 25W (R7)	53A-3RKA	1	1	B25(DAL)
13	Sems 6-32 x 3/8	83A-6-6B	2		
14	Plate, Recorder Center	650-103	1		
15	Screw, Shoulder	838-7	2		
16	Retainer, Bearing	650-642	1		
	Sems, 6-32 x 7/16	83A-6-7B	2		

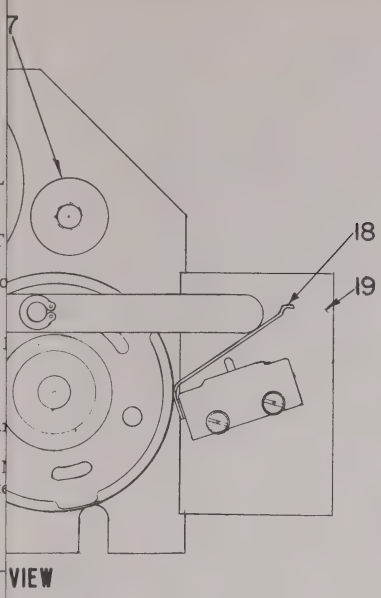
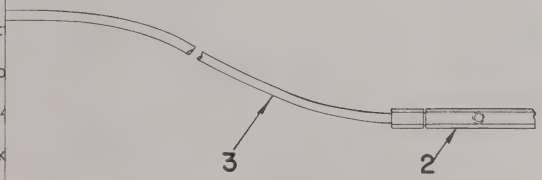


Figure 10. BRAKE ROL

REF. NO.	DESCRIPT
1	Paper Brake (Static
2	Clamp (Spring) Set Screw 8-32 x
3	Spring
4	Paper Brake & Bear consisting of: Paper Brake, Bearing, Oilit
5	Spring Washer
6	Paper Brake (Live-
7	Screw, Pan Hd. 6-
8	Washer
9	Collar (Paper Brak
10	Pin (Brake Actuatin
11	Side Plate (Paper B
12	Screw, Shoulder 1(
13	Hex Nut 6-32
14	Bracket (Brake Act
15	Sems 8-32 x 1/2 lo
16	4-40 cap Screw 1/
17	Spacer (Paper Brak
18	Switch (S4B) Formed Leaf Actu Sems 2-56 x 7/16
19	Bracket (Switch Mo
20	Spacer (Paper Brak
21	Solenoid
22	Linkage (Brake Act
23	Sems 4-40 5/16 lo
24	Retainer Ring 1/8
25	Sems 6-32 x 3/16



URE 12. FLEXIBLE SHAFT ASSEMBLY

EXIBLE SHAFT ASSEMBLY 650-300-C6

DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
	650-340	1		
et 6-32 x 1/8 long	81A-632-A	1		
	650-338	1		
exible 8-1/2"	32S-1	1	1	

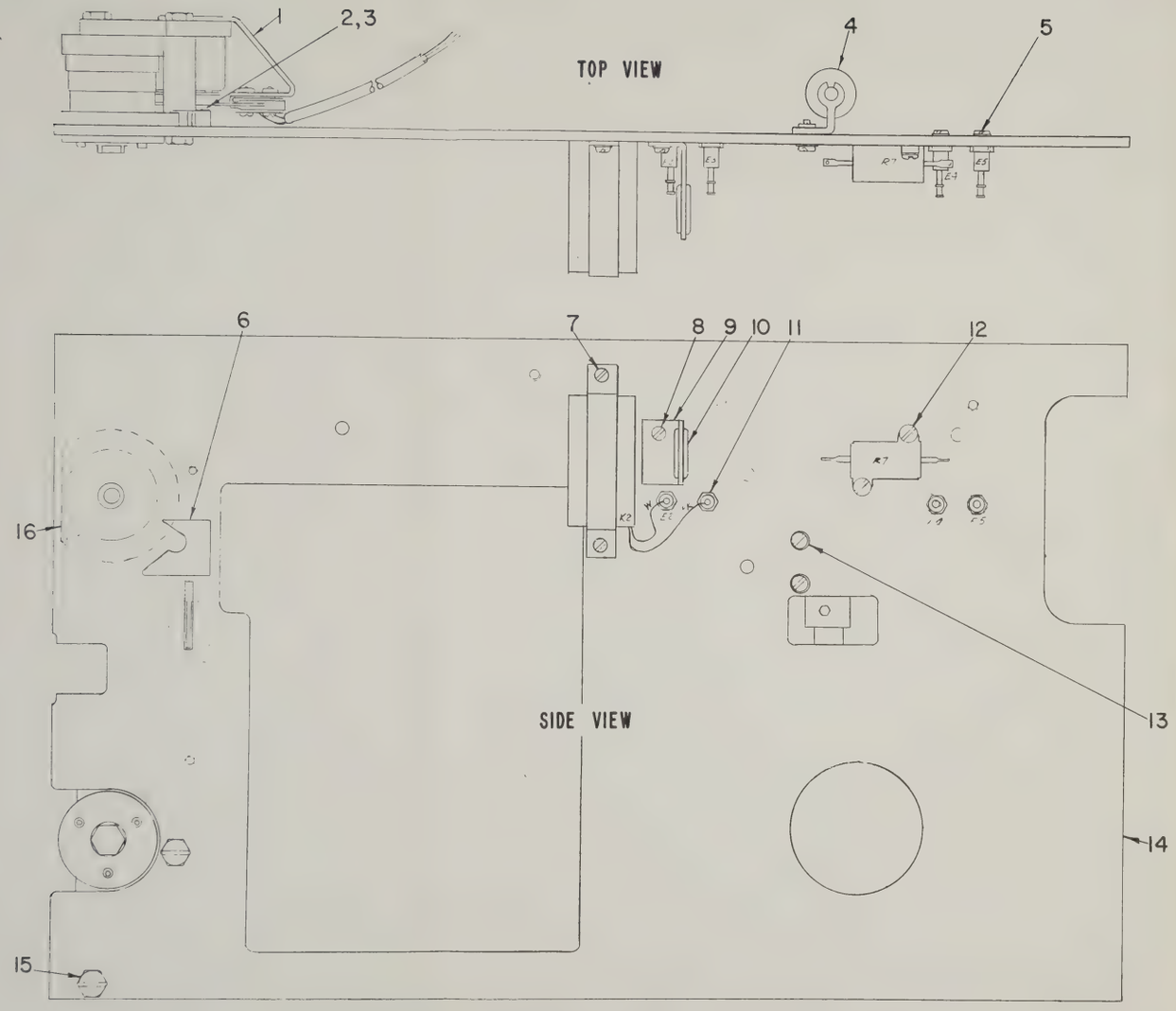


FIGURE 9. RECORDER CENTER PLATE ASSEMBLY

Figure 9. RECORDER CENTER PLATE ASSEMBLY MODEL 650-100-C16

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Paper Brake Assembly (See Figure 10)	650-600-C4	1		
2	Support, Left (Marker)	650-136	1		
3	Sems 4-40 x 7/16	83A-4-7B	1		
4	Dual Pulley and Bracket Assembly (See Figure 11)	650-100-C9	1		
5	Sems 4-40 x 3/8 long	83A-4-6B	6		
6	Locating Plate (Idler Roll) Sems 8-32 x 5/16	650-628 83A-8-5B	1 2		
7	Coil, Vacuum Switch (K2) Sems 6-32 x 5/16-1/4 Bracket, Vacuum Switch Coil Sems 6-32 x 5/16 long	62R-34 83A-6-4B 801-62P1 83A-6-5B	1 1 2 2	2	VS-2(EMC)
8	Sems 6-32 x 5/16 long	83A-6-5B	1		
9	Bracket Vacuum Switch	650-140	1		
10	Grommet, Rubber	77A-23	1		
11	Standoff, insulated (E2, E3, E4, E5)	34E-1	4		
12	Resistor 3 ohm 25W (R7)	53A-3RKA	1	1	B25(DAL)
13	Sems 6-32 x 3/8	83A-6-6B	2		
14	Plate, Recorder Center	650-103	1		
15	Screw, Shoulder	838-7	2		
16	Retainer, Bearing Sems, 6-32 x 7/16	650-642 83A-6-7B	1 2		

Figure 10. BRAKE ROLL ASSEMBLY MODEL 650-600-C4

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Paper Brake (Stationary)	650-608	1	1	
2	Clamp (Spring)	650-636	1		
	Set Screw 8-32 x 1/8 long	81A-832A	4		
3	Spring	358-706	1		
4	Paper Brake & Bearing Assembly consisting of:	650-600-C14			
	Paper Brake, Movable	650-609	1	1	
	Bearing, Oilite	5A-58	1	1	
5	Spring Washer	152-191	1		
6	Paper Brake (Live-Head)	650-610	1	1	
7	Screw, Pan Hd. 6-32 x 1/4 long	80A-6-4B	1		
8	Washer	710A-16	1		
9	Collar (Paper Brake)	650-633	1		
10	Pin (Brake Actuating)	650-645	1		
11	Side Plate (Paper Brake)	650-615	1		
12	Screw, Shoulder 10-32	838-7	2		
13	Hex Nut 6-32	- -	2		
14	Bracket (Brake Actuating)	650-631	1		
15	Sems 8-32 x 1/2 long	83A-8-8B	2		
16	4-40 cap Screw 1/4 long	82A-4-4	3		
17	Spacer (Paper Brake)	701-16T10-42	1		
18	Switch (S4B)	62C-10	1	1	SM(ACRO)
	Formed Leaf Actuator	62C-10A	1		
	Sems 2-56 x 7/16 long	83A-2-7B	2		
19	Bracket (Switch Mounting)	650-646	1		
20	Spacer (Paper Brake)	701-14710-42	1		
21	Solenoid	61R-2	1	1	(SAN)
22	Linkage (Brake Actuating)	650-635	1		
23	Sems 4-40 5/16 long	83A-4-5B	1		
24	Retainer Ring 1/8 External	59A-13	2		
25	Sems 6-32 x 3/16 long	83A-6-3B	2		

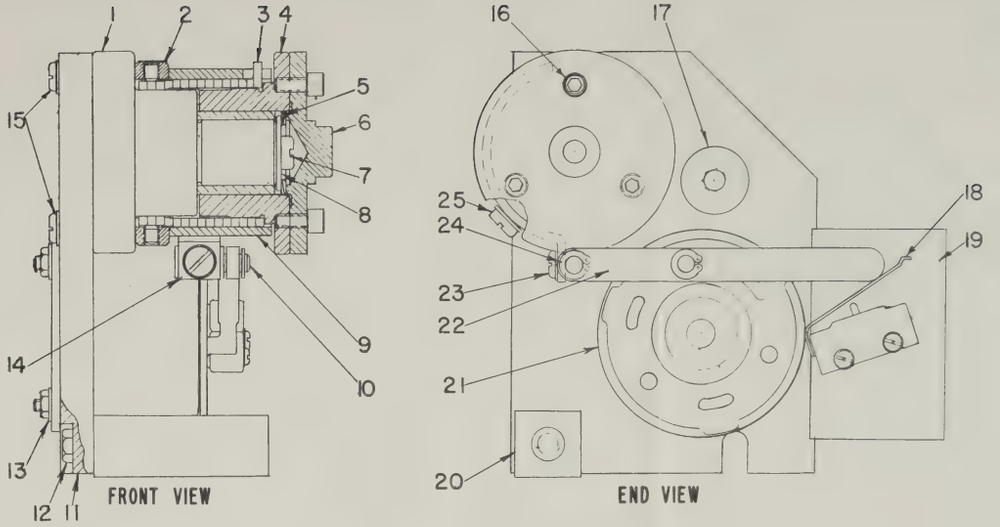


FIGURE 10. PAPER BRAKE ASSEMBLY

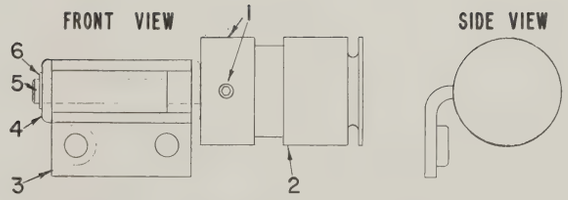


FIGURE 11. DUAL PULLEY AND BRACKET ASSEMBLY

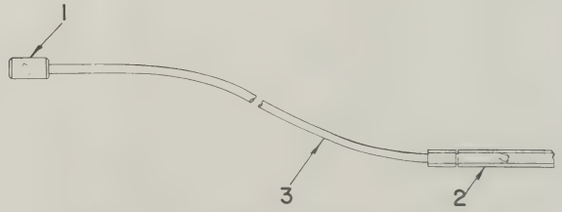


FIGURE 12. FLEXIBLE SHAFT ASSEMBLY

Figure 11. DUAL PULLEY AND BRACKET ASSEMBLY 650-100-C9

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Screw, Set 8-32	81A-832B	2		
2	Pulley, Dual (Beam Interrupter)	650-142	1	1	
3	Bracket	650-124	1		
4	Bearing Oilite	5A-11A	2	1	
5	Shaft, Long (Beam Interrupter)	650-139	1		
6	Grip Ring	59C-2	1		

Figure 12. FLEXIBLE SHAFT ASSEMBLY 650-300-C6

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Adapter	650-340	1		
	Screw, Set 6-32 x 1/8 long	81A-632-A	1		
2	Shaft	650-338	1		
3	Shaft, Flexible 8-1/2"	32S-1	1	1	

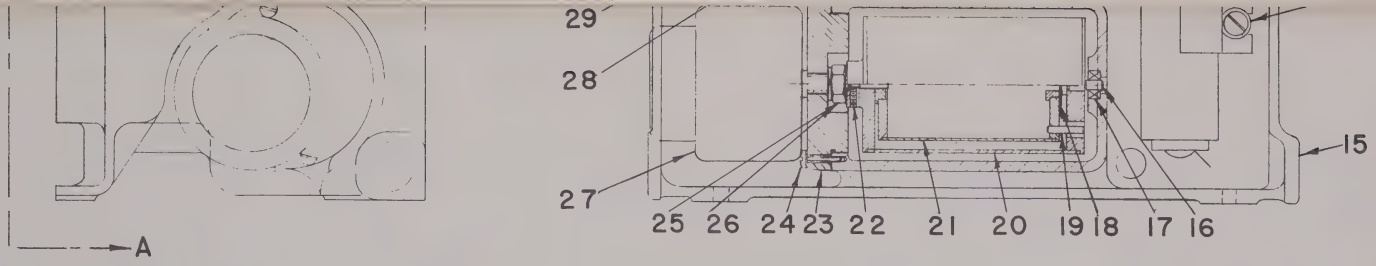


FIGURE 14. LAMP HOUSING AND TIMING ASSEMBLY

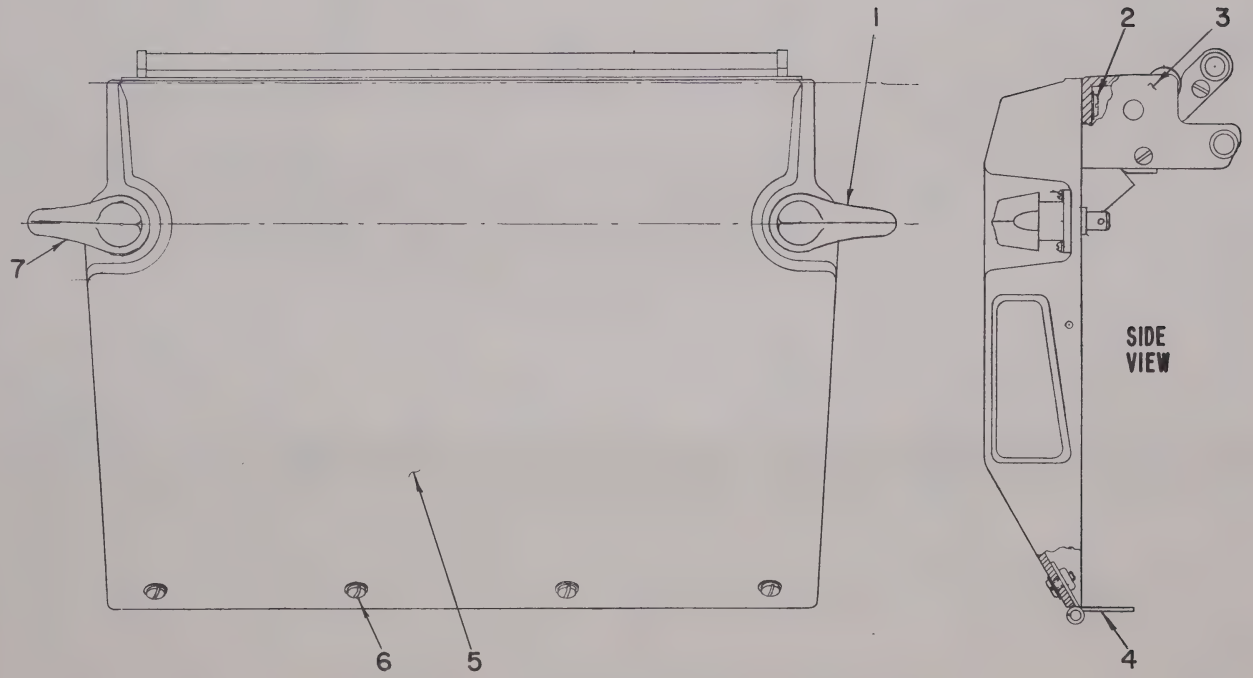


FIGURE 16. DOOR, PAPER LOADING ASSEMBLY

Figure 13. LAMP HOUSIN

REF. NO.	DESCRIPTIO
1	Mirror, Front Surfa
2	Flexible Shaft Intens (See Figure 12)
3	Mirror Support Asse consisting of: Tab, Mirror Su Mirror Support
4	Lamp Housing and T
5	Clamp, Lens Trace
6	Holder, Trace Colle
7	Screw, Adj. Lens
8	Washer, Spherical
9	Holder, Trace Colle
10	Spring, Compressio
11	Light Intensity Trim
12	Mirror, Front Surfa
13	Spring, Lamp Housi
14	Support, Left
15	"E" Ring Bowed
16	Sems 4-40 1/4 long
17	Slide, Lens
18	"O" Ring
19	Lens Holder & Lens Holder, Lens (Lamp) Lens
20	Jack, Lens Adjust

APER SPINDLE ASSEMBLY 650-600-C6

DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
n 3/32 dia. 7/8 long	44J-6-56	1		
, Paper	650-630	1	1	
	37G-6	1		
	6A-2	1		

OOR ASSEMBLY, PAPER LOADING 650-600-C3

DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
Door (Right) (See Figure 17)	650-600-C12	1	1	
-56-3/16 long	83A-2-3B	2		
-32 x 3/8 long	83A-6-6B	6		
e Roll Bracket Assembly gure 18)	650-600-C2	1		
Paper Loading Door	826-24	1		
aper Loading	650-601	1		
6-32 x 5/16 long	83A-6-5B	4		
Door (Left) (See Figure 19)	650-600-C13	1		
-56 x 3/16 long	83A-2-3B	2		

Figure 14. LAMP HOUSIN

REF. NO.	DESCRIP
1	Support Lamp Asse consisting of: Support, Lamp Insert, 4-40 x Screw, Bd. Hd
2	High Voltage Electro consisting of: Lug #8 hole Spacers, Insul Braided Wire, Lug #10 hole

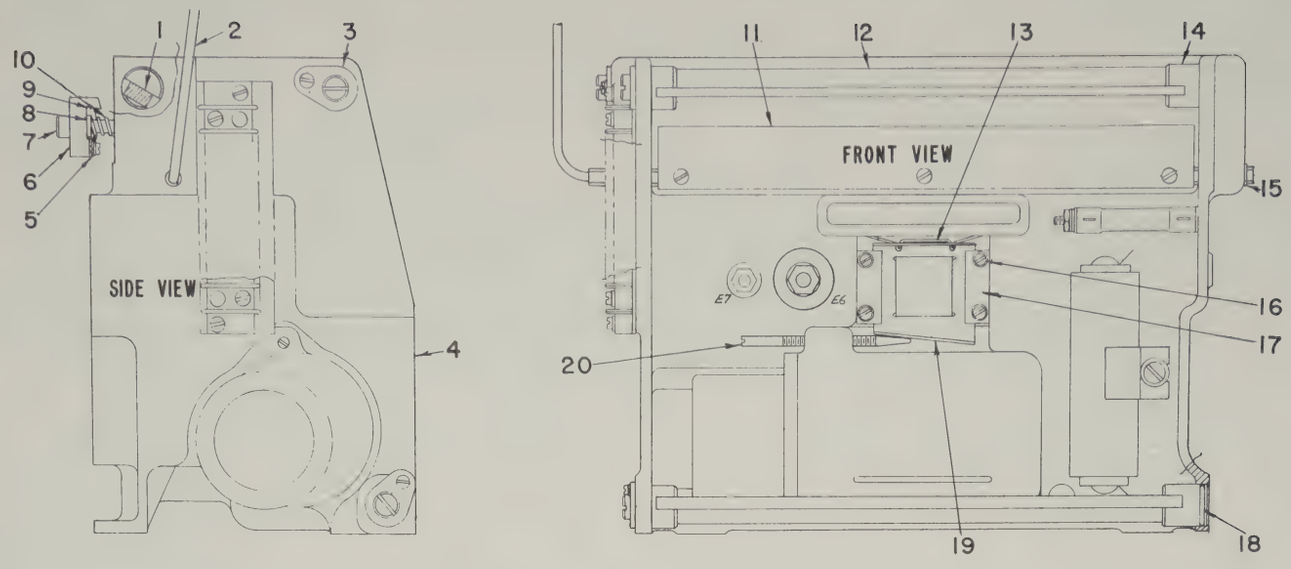
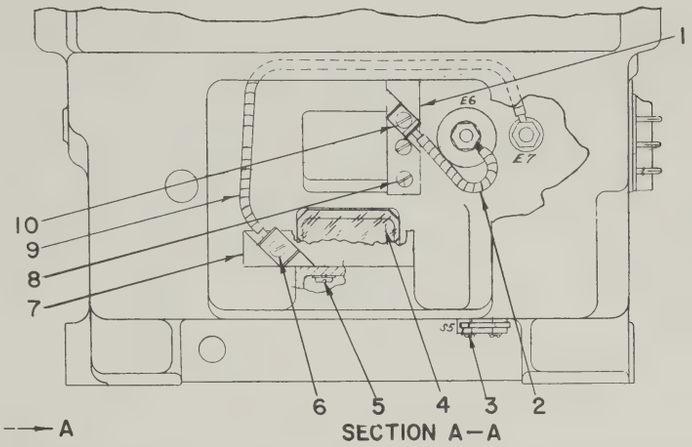


FIGURE 13. LAMP HOUSING COMPLETE ASSEMBLY



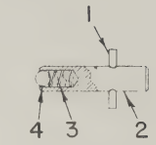


FIGURE 15. SPINDLE PAPER ASSEMBLY

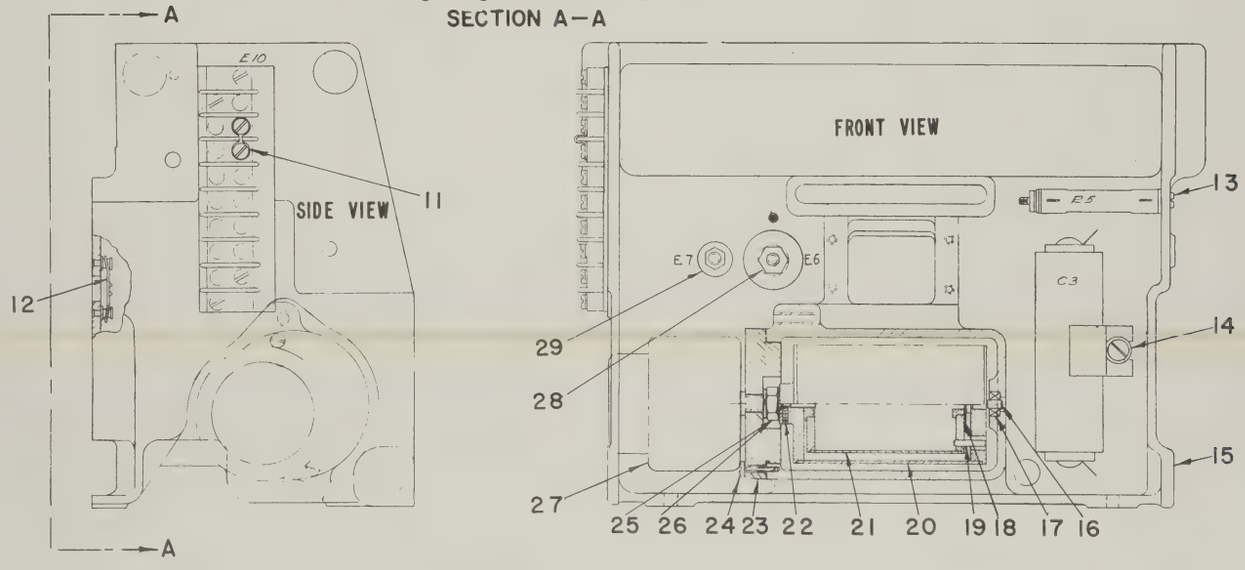


FIGURE 14. LAMP HOUSING AND TIMING ASSEMBLY

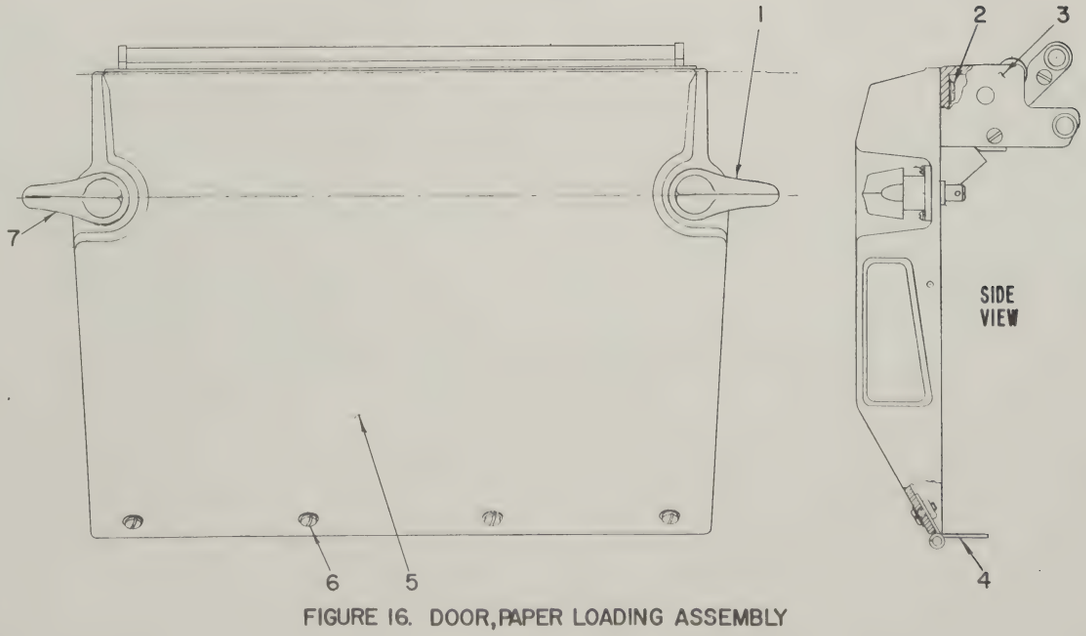


FIGURE 16. DOOR, PAPER LOADING ASSEMBLY

Figure 13. LAMP HOUSING COMPLETE ASSEMBLY 650-300-C10

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Mirror, Front Surface	650-342	1		
2	Flexible Shaft Intensity Control Assembly (See Figure 12)	650-300-C6			
3	Mirror Support Assembly (Right) consisting of:	650-300-C3	3		
	Tab, Mirror Support (Right)	650-336	1		
	Mirror Support (Right)	650-323	2		
4	Lamp Housing and Timing (See Figure 14)	650-300-C9	1		
5	Clamp, Lens Trace Collector	650-345	2		
6	Holder, Trace Collector Lens	650-341	1		
7	Screw, Adj. Lens	650-343	2		
8	Washer, Spherical	650-344	2		
9	Holder, Trace Collector	650-312	2		
10	Spring, Compression	824-48	2	2	
11	Light Intensity Trim	650-339	1		
12	Mirror, Front Surface	650-314	2		
13	Spring, Lamp Housing	650-322	1	1	
14	Support, Left	650-316	3		
15	"E" Ring Bowed	59A-27	2		
16	Sems 4-40 1/4 long	83A-4-4B	14		
17	Slide, Lens	650-324	2		
18	"O" Ring	77A-47	3	3	
19	Lens Holder & Lens Assembly	650-300-C4	1		
	Holder, Lens (Lamp)	650-317	1		
	Lens	650-313	1		
20	Jack, Lens Adjust	650-327	1		

Figure 14. LAMP HOUSING AND TIMING ASSEMBLY 650-300-C9

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Support Lamp Assembly (Upper) consisting of:	650-300-C8	1		
	Support, Lamp (Upper)	650-332	1		
	Insert, 4-40 x .25	40L-4			
	Screw, Bd. Hd. 4-40 x 1/2 long	80A-440-8B			
2	High Voltage Electrode Assembly consisting of:	650-100-C33	1		
	Lug #8 hole	34A-30	1		
	Spacers, Insulating Beads	32D-1	12		
	Braided Wire, Round 3.06 long	W180-6-1			
	Lug #10 hole	34A-46	1		
3	Switch, Acro (S5)	62C-10	1	1	SM(ACR)
	Actuator, Acro Switch	62C-10A	1		
	Sems 2-56 x 3/8 long	83A-2-6B	2		
4	Window, Timing Mechanism	650-346	1	1	
5	Sems, 6-32 x 3/8 long	83A-6-6B	2		
6	Clip Lamp	12A-38	1	1	
	Sems #4-40 x 1/4 long	83A-4-4B	2		
7	Lamp Support Assembly (Lower) consisting of:	650-300-C7	1		
	Support, Lamp (Lower)	650-331	1		
	Insert, 4-40 x 2.5	40L-4	1		
8	Sems 4-40 x 3/4 long	83A-4-12B	1		
9	Low Voltage Electrode Assembly consisting of:	650-100-C22	1		
	Lug	34A-30	2		
	Spacers, insulating beads	32D-1	42		
	Braided Wire, Round 7.50 long	W180-16-1			
10	Clip, Lamp	12A-4	1	1	
	Sems 4-40 x 1/4 long	83A-4-4B			
11	Strip, Barrier (E10)	64G-1	1		
	Strip, Backing	64G-1MSX	1		
	Sems 6-32 x 1/2 long	83A-6-8B	2		
	Barrier Strap	34A-37	1		
12	Latch Receptacle	75A-40	2		
	Rivet 3/32 dia. 5/16 long Fl. Hd.	47A-27	4		
13	Resistor 800 ohm 10W (R5)	53A-801-K	1	1	1-3/4A(IRC)
	Screw 6-32 Bd. Hd. 2-1/4 long	80A-632-36B	1		
	Washer #6 Flat Fiber	74F-6G	2		
	Washer #6 Flat	74A-6L	1		
	Nut, #6 Keps	40T-6	1		
14	Capacitor 1 mfd. 220 VAC (C3)	8B-128	1	1	VC2026(CD)
	Sems 10-32 x 1/4 long	83A-10-4B	1		
	Washer #10 Flat	74A-10S	1		
15	Lamp Housing	650-301	1		
16	Shaft, Timing Drum	650-333	1		
17	Bearing	4E-2P	1	1	
18	Washer	710N-10	1		
19	Stop, Indexing	650-330	1		
20	Drum, Outer	650-306	1		
21	Drum, Inner (Timer)	650-305	1		
22	Set Screw 4-40 x 3/16 long	81D-4-3A	2		
23	Retainer, Motor	650-318	1		
24	Sems 4-40 7/16 long	83A-4-7B	2		
25	Nut, hex 1/4 - 28	40M-23	1		
26	Lockwasher, Split 1/4 I.D.	71B14-63	1		
27	Motor (Timing Generator) 300 rpm	38B-47	2	1	(SAN)
28	Terminals Pre-Assembled High Voltage (E6)	14F-4	1		
29	Terminals Pre-Assembled High Voltage (E7)	14F-3	1		

Figure 15. PAPER SPINDLE ASSEMBLY 650-600-C6

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Roll Pin 3/32 dia. 7/8 long	44J-6-56	1		
2	Spindle, Paper	650-630	1	1	
3	Spring	37G-6	1		
4	Ball	6A-2	1		

Figure 16. DOOR ASSEMBLY, PAPER LOADING 650-600-C3

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Latch, Door (Right) (See Figure 17)	650-600-C12	1	1	
	Sems 2-56-3/16 long	83A-2-3B	2		
2	Sems 6-32 x 3/8 long	83A-6-6B	6		
3	Pressure Roll Bracket Assembly (See Figure 18)	650-600-C2	1		
4	Hinge, Paper Loading Door	826-24	1		
5	Door, Paper Loading	650-601	1		
6	Sems #6-32 x 5/16 long	83A-6-5B	4		
7	Latch, Door (Left) (See Figure 19)	650-600-C13	1		
	Sems 2-56 x 3/16 long	83A-2-3B	2		

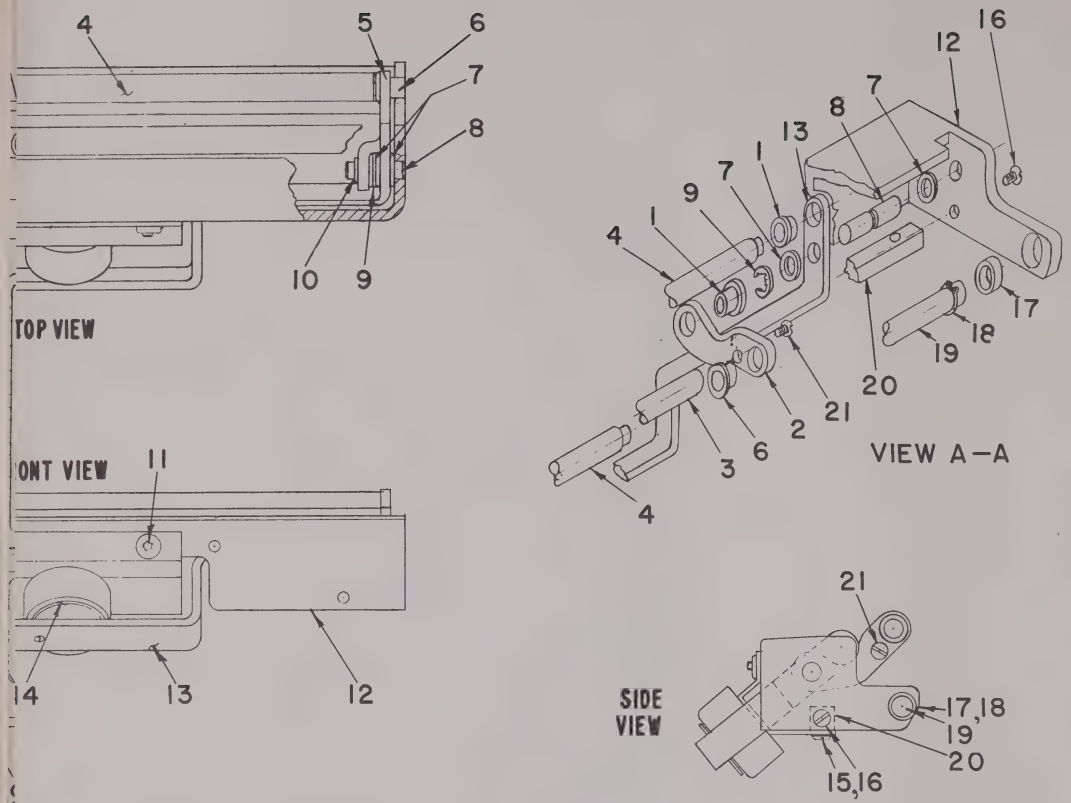


FIGURE 18. PRESSURE ROLL ASSEMBLY

)-C2

O.	T.Q.	R.S.	VENDOR NO.					
	1	1		12	Bracket, Pressure Roll	650-602	1	
	1			13	Bracket, Pressure Roll	650-620	1	
3	1			14	Solenoid	61R-3	1	
	2			15	Bracket, Solenoid	650-616	1	
	1			16	Screw, Flat Hd. 8-32 1/4 long	80A-832-4D	2	
	2	1		17	Bearing, Oilite (Sleeve)	5A-52	2	1
	4	1		18	Ring, Retaining 5/16	59A-9	2	
	2			19	Idler Roll Platen	650-617	1	
	2			20	Spacer	650-611	1	
	1	1		21	Screw, Flat Head 4-40 x 1/4 long	80A-440-4D	2	

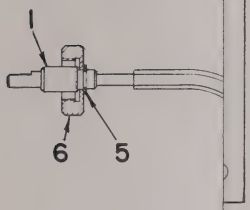


FIGURE 20

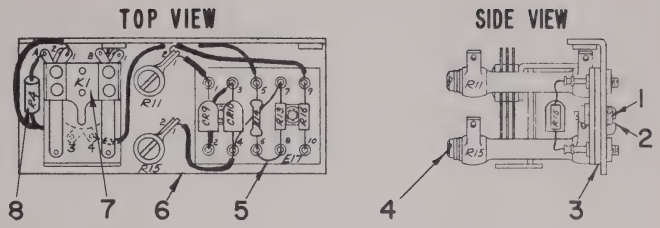


FIGURE 22. BRACKET, RELAY, ASSEMBLY

Figure 20. VARIAC ADJU BRACKET ASSEMBLY, RELAY 650-100-C11

REF. NO.	DESCRIPTI	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Adapter, Variac Adj	4-40 x 7/16 long	83A-4-7B	2		
2	Tygon Tubing, 9" lg.	8-32 x 3/8 long	83A-8-6B	2		
3	Collar, Variac	Terminal Backing	751-13	1		
4	Shaft, Flexible	or 35 ohm 10W W.W. (R11, R15)	53A-350K	2	1	1-3/4A(IRC)
		r, Fiber	74R-1	4		
5	Ring, Retaining	r, Flat #6	74A-6L	2		
		asher #6	73A-6	2		
6	Nut, Lens Adjust	, Binding Hd. 6-32 x 2" long	80A-632-32B	2		
		nal Board Assembly	650-100-C32	1		
		ting of:				
		Board, Terminal	750-10-4	1		
		Nuts, Clinch	40F-440-2	2		
		Lugs, Turret	34B-8	10		
		Diode (CR9, CR10)	16A-39	2	1	1N2069(TEX)
		Resistor 50K 1/4W 1% (R14)	50H-503G	1	1	N-11(WEL)
		Resistor 2.7K 1/2W 5% (R13)	50AB-272J	1	1	EB(AB)
		Resistor 220Ω 1/2W 5% (R16)	50AB-221J	1	1	EB(AB)
		t, Relay Mounting	650-122	1		
		DPDT (K1)	62R-37	1		GA-11D(POT)
		or 180Ω 2W (R4)	52C-181J	1	1	HB(AB)

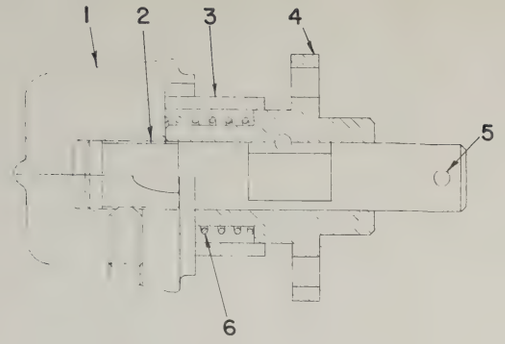


FIGURE 17. LATCH, DOOR, RIGHT HAND

Figure 17. DOOR LATCH ASSEMBLY (RIGHT) 650-600-C12

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Knob	32A-30	1	1	
2	Shaft (Right)	650-652	1		
3	Sleeve	650-653	1		
4	Bushing	650-650	1		
5	Pin, Roll 1/16 x 3/8 long	44J-4-24	2		
6	Spring	824-47	1		

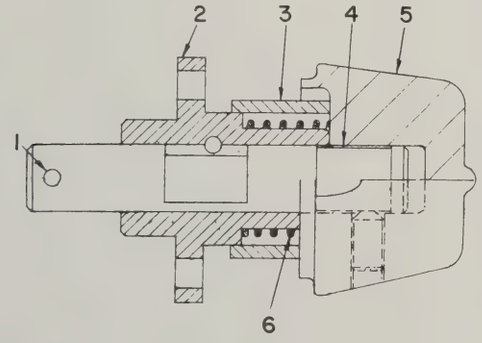


FIGURE 19. LATCH, DOOR, LEFT HAND

Figure 19. LATCH DOOR (LEFT) 650-600-C13

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Pin, Roll 1/16 x 3/8 long	44J-4-24	2		
2	Bushing	650-650	1		
3	Sleeve	650-653	1		
4	Shaft (Left)	650-651	1		
5	Knob	32A-30	1	1	
6	Spring	824-47	1		

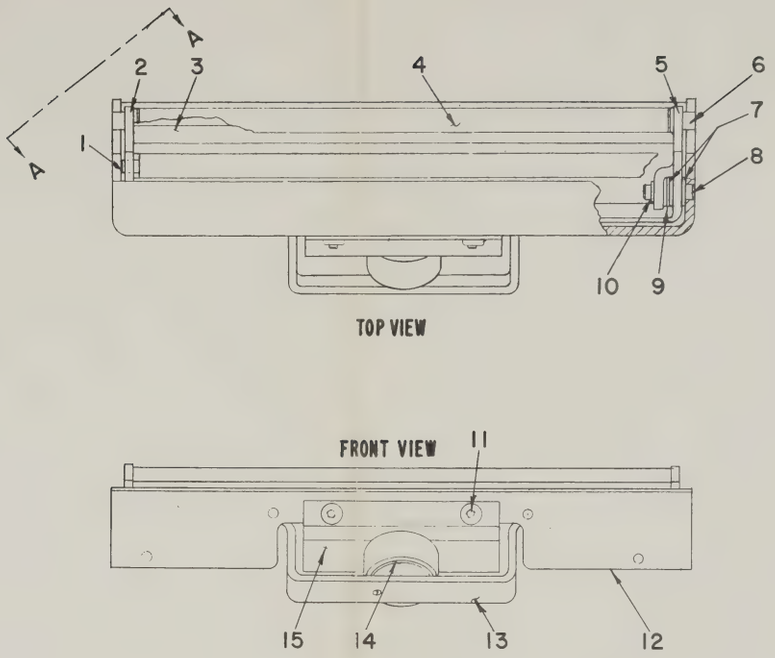


FIGURE 18. PRESSURE ROLL ASSEMBLY

Figure 18. PRESSURE ROLL BRACKET ASSEMBLY 650-600-C2

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Bearing, oilite, 1/4" long	5A-57	1	1	
2	Bracket, Platen Roll (Left)	650-619	1		
3	Spacer	701-8T4-263	1		
4	Pressure Roll	650-627	2		
5	Bracket, Platen Roll (Right)	650-618	1		
6	Bearing, Oilite, 3/8" Long	5A-56	2	1	
7	Bearing, Thrust	5A-16	4	1	
8	Pivot Pressure Roll	650-634	2		
9	"E"Ring	59A-14	2		
10	Bearing, Oilite	5A-57	1	1	
11	Sems 6-32 5/16 long	83A-6-5B	4		
12	Bracket, Pressure Roll	650-602	1		
13	Bracket, Pressure Roll	650-620	1		
14	Solenoid	61R-3	1		
15	Bracket, Solenoid	650-616	1		
16	Screw, Flat Hd. 8-32 1/4 long	80A-832-4D	2		
17	Bearing, Oilite (Sleeve)	5A-52	2	1	
18	Ring, Retaining 5/16	59A-9	2		
19	Idler Roll Platen	650-617	1		
20	Spacer	650-611	1		
21	Screw, Flat Head 4-40 x 1/4 long	80A-440-4D	2		

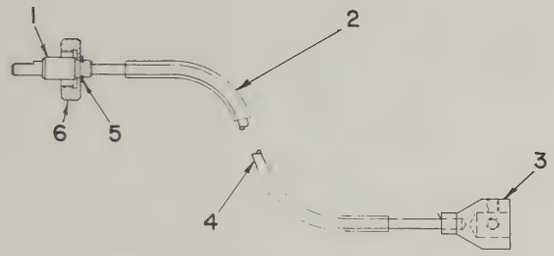


FIGURE 20. VARIAC ADJUST ASSEMBLY

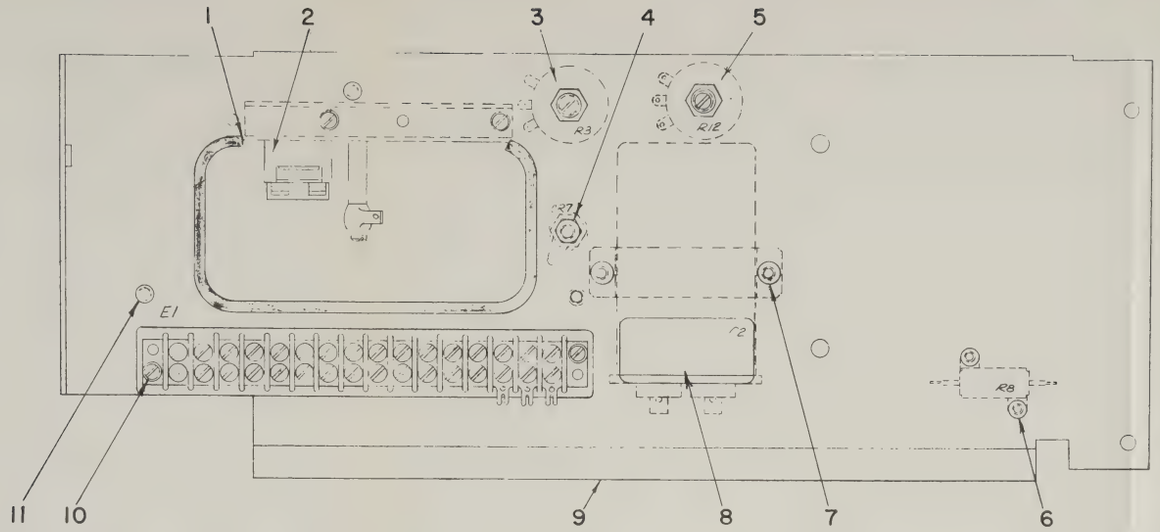


FIGURE 21. CHASSIS, UPPER, ASSEMBLY

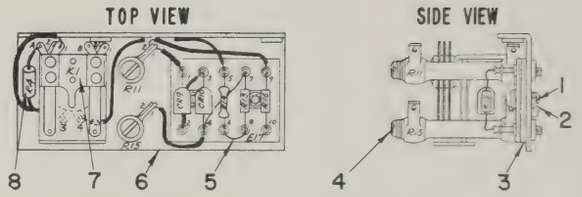


FIGURE 22. BRACKET, RELAY, ASSEMBLY

Figure 20. VARIAC ADJUST ASSEMBLY 650-100-C23

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Adapter, Variac Adjust	650-163	1		
2	Tygon Tubing, 9" lg., 5/32 I.D. 9/32 O.D.	PT-3	1		
3	Collar, Variac	650-162	1		
4	Shaft, Flexible	32S-2	1	1	
5	Ring, Retaining	59A-13	1		
6	Nut, Lens Adjust	650-325	1		

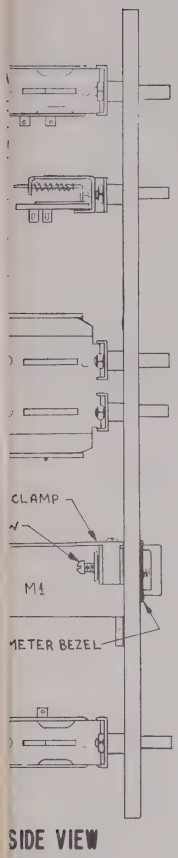
Figure 21. UPPER CHASSIS ASSEMBLY MODEL 650-100-C10

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Channel, Rubber 10" long	RC-1	1		
2	Bracket Assembly, Relay (See Figure 22)	650-100-C11	1		
	Sems 6-32 x 1/4 long	83A-6-4B	4		
3	Potentiometer, Screwdriver Adjust 5K (R3)	56A-49	1	1	#37T(CLA)
4	Diode (CR7)	16A-48	1	2	10JB3(SPR)
	Lockwasher #10	73A-10	1		
	Nut, Hex #10-32	- -	1		
	Lug	34A-22	1		
5	Potentiometer, Screwdriver Adjust 100 Ω (R12)	56A-89	1	1	#43T(CLA)
6	Resistor 10Ω 25W (R8)	53A-100K	1	1	B25(DAL)
7	Sems 6-32 x 1/4 long	83A-6-4B	4		
8	Condenser & Bracket 5 mfd. 330 VAC (C2)	8B-126	1	1	P150F214(AER)
9	Chassis, Upper	650-143	1		
10	Barrier Strip 16-contact (E1)	64R-4	1		
	Strip, Terminal backing	751-13	1		
	Sems 4-40 x 5/16 long	83A-4-5B	2		
11	Spacer	47K-1	3		

Figure 22. BRACKET ASSEMBLY, RELAY 650-100-C11

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Sems, 4-40 x 7/16 long	83A-4-7B	2		
2	Sems 8-32 x 3/8 long	83A-8-6B	2		
3	Strip, Terminal Backing	751-13	1		
4	Resistor 35 ohm 10W W.W. (R11, R15)	53A-350K	2	1	1-3/4A(IRC)
	Washer, Fiber	74R-1	4		
	Washer, Flat #6	74A-6L	2		
	Lockwasher #6	73A-6	2		
	Screw, Binding Hd. 6-32 x 2" long	80A-632-32B	2		
5	Terminal Board Assembly consisting of:	650-100-C32	1		
	Board, Terminal	750-10-4	1		
	Nuts, Clinch	40F-440-2	2		
	Lugs, Turret	34B-8	10		
	Diode (CR9, CR10)	16A-39	2	1	1N2069(TEX)
	Resistor 50K 1/4W 1% (R14)	50H-503G	1	1	N-11(WEL)
	Resistor 2.7K 1/2W 5% (R13)	50AB-272J	1	1	EB(AB)
	Resistor 220Ω 1/2W 5% (R16)	50AB-221J	1	1	EB(AB)
6	Bracket, Relay Mounting	650-122	1		
7	Relay DPDT (K1)	62R-37	1		GA-11D(POT)
8	Resistor 180Ω 2W (R4)	52C-181J	1	1	HB(AB)

Figure 23. PANEL ASSEMBLY MODEL 650-100-C7



REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Lamp, Neon (I1)	30B-1	1	4	NE-51(GE)
	Lamp Holder (XI1)	60A-22	1		
	Lens, Red	60A-22E	1		
2	Meter, Lamp Wattage (M2)	36A-17	1	1	(SAN)
3	Lamp 1.35V (I5)	30A-22	1	4	39-1.35-1432(DIAL)
	Holder, Lamp (XI5)	60A-36	1		
4	2-button Switch Assembly, Lamp (S4) (See Figure 24)	650-100-C18	1		
	Spacer	701-10D140-4	10		
	Kep Nut 6-32	40T-6	12		
5	1-button Switch Assembly, (S3) consisting of:	62P-4	1		
	Bracket, Switch	650-120	1		
	Sems 6-32 x 3/16	83A-6-3B	2		
6	10-button Switch, Paper Speed (S2) (See Figure 25)	650-100-C19	1		
7	Meter, Footage Indicator with Mounting	36A-13	1	1	1120(III)
8	Power & Timing Switch Assembly (S1) (See Figure 26)	650-100-C17	1	1	
9	Paper Stop & Record Switch Assembly (S6) (See Figure 27)	650-100-C21	1		
	Spacer	701-10D140-4	2		
	Kep Nut 6-32	40T-6	2		
10	Panel (Mechanical) Assembly (See Figure 28)	650-100-C6	1		

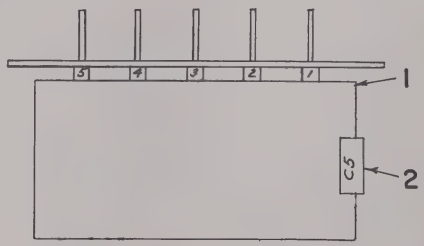
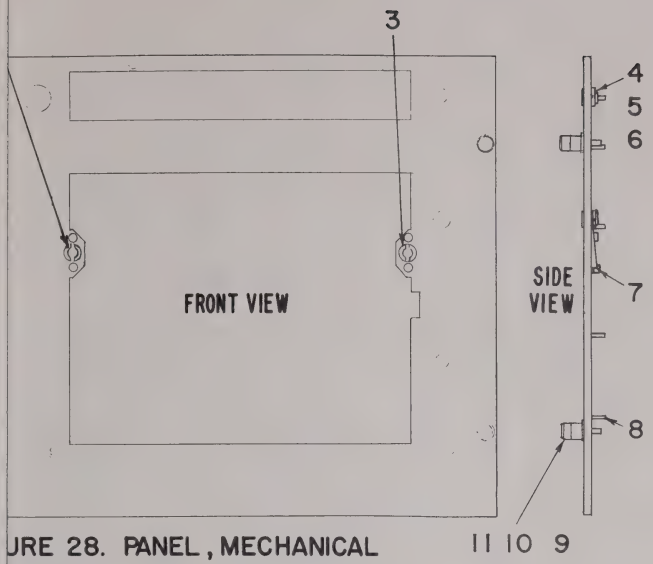


FIGURE 25. 10 BUTTON SWITCH, PAPER SPEED, S2

Figure 25. 10-BUTTON SWITCH ASSEMBLY, PAPER SPEED (S2) 650-100-C19

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Switch, 10 pushbutton (S2)	62P-8	1	1	(SAN)
2	Capacitor, .1 mfd 200V (C5)	8B-66	1	1	WMF(CD)



URE 28. PANEL, MECHANICAL

Figure 26. POWER & TIN L (MECHANICAL) ASSEMBLY 650-100-C6

REF. NO.	DESCRIPT	ESCRIPTION	SANBORN NO.	T. Q.	R. S.	VENDOR NO.
1	Switch, Push Button		650-101	1		
2	Switch, Acro (S1A)		650-649	1		
	Bracket, Acro Switc					
	Sems 2-56 x 1/2 lon		650-648	1		
	Lockwasher #2					
	Nuts, Hex 2-56		169-134	2		
	Sems 4-40 x 1/4 lon					
	Keps 4-40	8 - 24	- -	2		
	Actuator					
			74A-375A	2		
		3/8 long	83A-632-6A	4		
			87D-6-10D	12		
		tener	75A-32	4		
		ng, Fastener	75A-32P2	4		
		stener	75A-32P3	4		

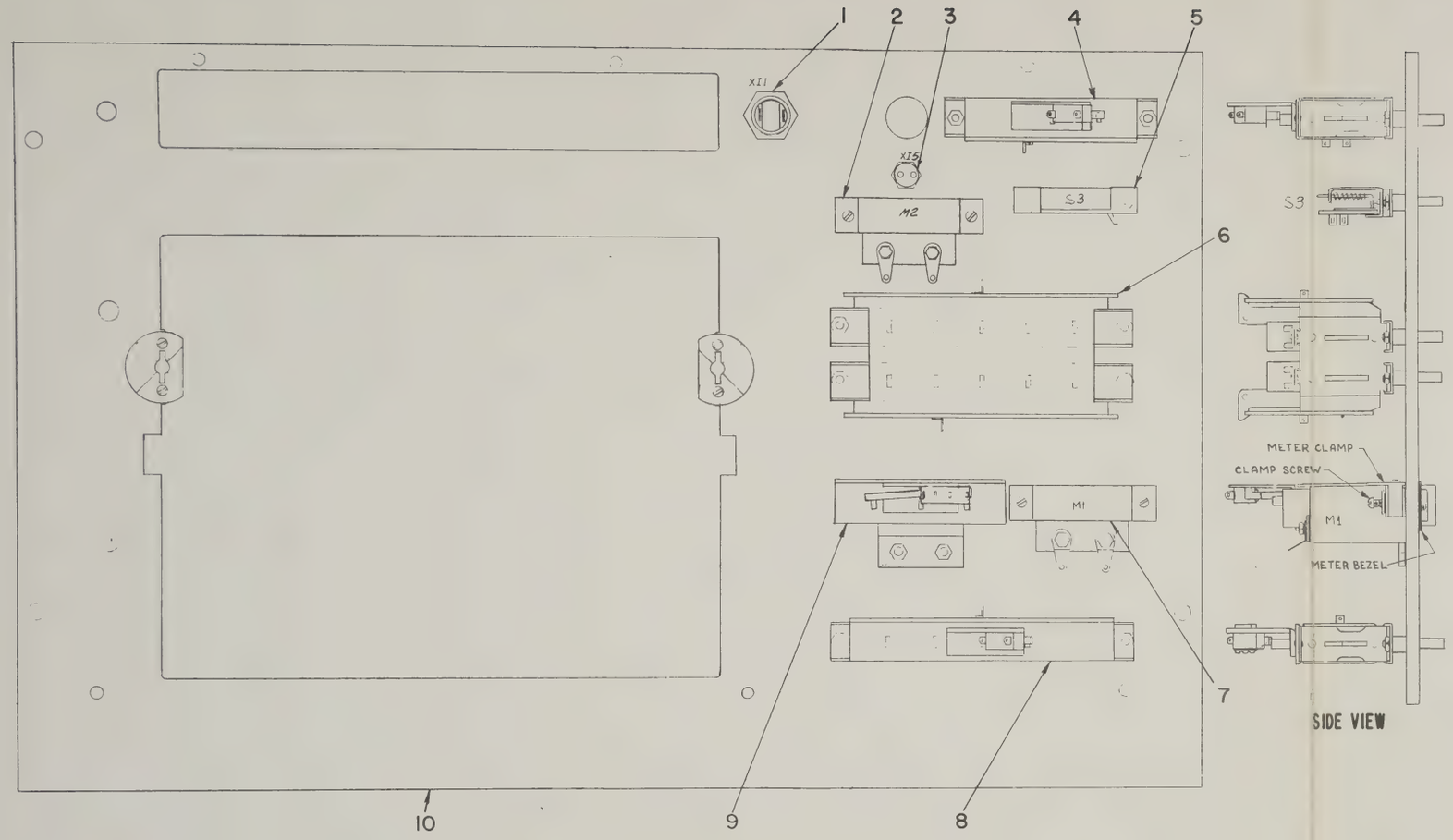


FIGURE 23. PANEL, ELECTRIC, ASSEMBLY

Figure 23. PANEL ASSEMBLY MODEL 650-100-C7

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Lamp, Neon (I1)	30B-1	1	4	NE-51(GE)
	Lamp Holder (XI1)	60A-22	1		
	Lens, Red	60A-22E	1		
2	Meter, Lamp Wattage (M2)	36A-17	1	1	(SAN)
3	Lamp 1.35V (I5)	30A-22	1	4	39-1.35-1432(DIAL)
	Holder, Lamp (XI5)	60A-36	1		
4	2-button Switch Assembly, Lamp (S4) (See Figure 24)	650-100-C18	1		
	Spacer	701-10D140-4	10		
	Kep Nut 6-32	40T-6	12		
5	1-button Switch Assembly, (S3) consisting of:	62P-4	1		
	Bracket, Switch	650-120	1		
	Sems 6-32 x 3/16	83A-6-3B	2		
6	10-button Switch, Paper Speed (S2) (See Figure 25)	650-100-C19	1		
7	Meter, Footage Indicator with Mounting	36A-13	1	1	1120(III)
8	Power & Timing Switch Assembly (S1) (See Figure 26)	650-100-C17	1	1	
9	Paper Stop & Record Switch Assembly (S6) (See Figure 27)	650-100-C21	1		
	Spacer	701-10D140-4	2		
	Kep Nut 6-32	40T-6	2		
10	Panel (Mechanical) Assembly (See Figure 28)	650-100-C6	1		

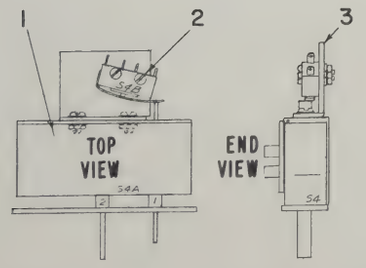


FIGURE 24. 2 BUTTON SWITCH, LAMP, S4

Figure 24. 2-BUTTON SWITCH ASSEMBLY, LAMP (S4) 650-100-C18

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Switch, Push Button (S4A)	62P-7	1	1	(SAN)
2	Switch, Acro (S4B)	62C-10	1	1	SM(ACR)
	Bracket, Acro Switch Mounting	650-159	1	1	
	Actuator	62C-10A	1		
	Sems, 2-56 x 1/2 long	83A-2-8B	2		
	Lockwasher #2	73A-2	2		
	Nut, Hex 2-56	- -	2		
	Sems 4-40 x 1/4 long	83A-4-4B	2		
	Keps 4-40	40T-4	2		

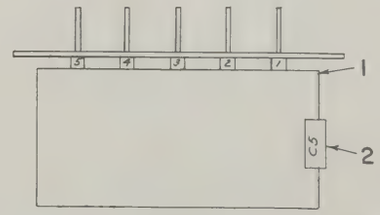


FIGURE 25. 10 BUTTON SWITCH, PAPER SPEED, S2

Figure 25. 10-BUTTON SWITCH ASSEMBLY, PAPER SPEED (S2) 650-100-C19

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Switch, 10 pushbutton (S2)	62P-8	1	1	(SAN)
2	Capacitor, .1 mfd 200V (C5)	8B-66	1	1	WMF(CD)

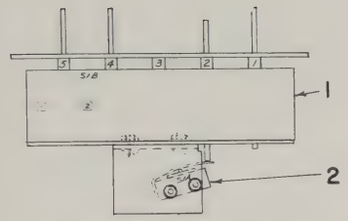


FIGURE 26. POWER AND TIMING SWITCH, SI

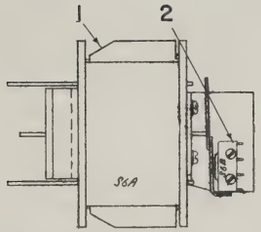


FIGURE 27. PAPER STOP AND RECORD SWITCH, S6

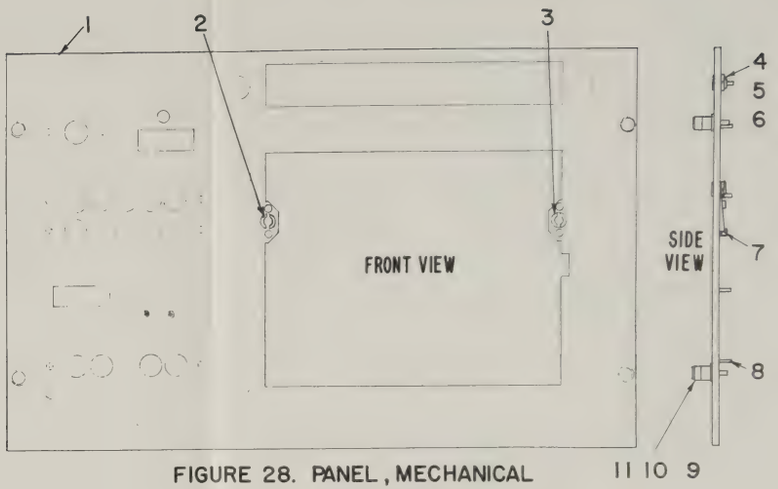


FIGURE 28. PANEL, MECHANICAL

Figure 26. POWER & TIMING SWITCH ASSEMBLY (S1) 650-100-C17

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Switch, Push Button (S1B)	62P-6	1	1	(SAN)
2	Switch, Acro (S1A)	62C-10	1	1	SM(ACR)
	Bracket, Acro Switch Mounting	650-159	1		
	Sems 2-56 x 1/2 long	83A-2-8B	2		
	Lockwasher #2	73A-2	2		
	Nuts, Hex 2-56	- -	2		
	Sems 4-40 x 1/4 long	83A-4-4B	2		
	Keps 4-40	40T-4	2		
	Actuator	62C-10A	1		

Figure 27. PAPER STOP & RECORD SWITCH ASSEMBLY (S6) 650-100-C21

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Switch, 3-position (S6A)	62P-5	1	1	(SAN)
	Sems 6-32 x 3/8 long	83A-6-6B	2		
	Bracket 3-position Switch	650-158	1		
2	Bracket, Acro Switch	650-159	1		
	Switch, Acro (S6B)	62C-10	1	1	SM(ACR)
	Actuator Assembly consisting of:	650-100-C28	1		
	Acuator	62C-10B	1		
	Leaf	650-182	1		
	Sems 2-56 x 1/2 long	83A-2-8B	2		
	Lockwasher #2	73A-2	2		
	Nut, Hex 2-56	- -	2		
	Sems 4-40 x 1/4 long	83A-4-4B	2		
	Nut, Kep 4-40	40T-4	2		
	Washer, Flat #2	74A-2	2		

Figure 28. PANEL (MECHANICAL) ASSEMBLY 650-100-C6

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Panel	650-101	1		
2	Cam, Left	650-649	1		
3	Cam, Right	650-648	1		
4	Bushing	169-134	2		
5	Nut, Hex 3/8 - 24	- -	2		
6	Washer	74A-375A	2		
7	Sems, 6-32, 3/8 long	83A-632-6A	4		
8	Pem Stud	87D-6-10D	12		
9	Screw, Fastener	75A-32	4		
10	Retainer Ring, Fastener	75A-32P2	4		
11	Standoff, Fastener	75A-32P3	4		

5	Gear	5G-31	1
6	Mini Clutch 61 H.U.	5C-4	1
7	Allen Set Screw, Cup Point 6-32 x 1/8	81A-632A	2
	SHAFT #7 (Parts are called from left to right on Figure.)		
1	Shaft #7 & #8	825-5	1
2	Spacer	358-715-P4	1
3	Gear	5G-34	1
4	Mini Clutch 61 H.U.	5C-4	1
5	Allen Set Screw, Cup Point 6-32 x 1/8	81A-632A	2
6	Gear	5G-29	1
7	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2
8	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2
9	Collar	358-717	1
	SHAFT #8 (Parts are called from left to right on Figure.)		
1	Shaft #7 & #8	825-5	1
2	Collar	358-717	1
3	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2
4	Allen Set Screw, Cup Point 8-32	81A-832C	2
5	Gear	5G-29	1
6	Gear	5G-34	1
7	Mini Clutch 61 H U	5C-4	1
8	Allen Head Set Screw, Cup Point 6-32 x 1/8	81A-632A	2
9	Spacer	358-715-P4	1
	SHAFT #9 (Parts are called from left to right on Figure.)		
1	Shaft #9	825-27	1
2	Pulley	5P-6	1
3	Allen Set Screw, Cup Point 8-32 x 3/16	81A-832B	2
4	Spacer	358-715-P3	1
5	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2
6	Gear	5G-35	1
7	Collar	358-717	1
8	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2
	GEAR BOX	358-700	
1	Cover (Lucite Top)	358-721	1
2	Side Plate Assembly (Right) consisting of:	358-700-C2	1
	Side Plate, Right	358-708	1
	Bearing	5A-34	4
	Bearing	5A-33	5
3	Sems 10-32 x 3/8	83D-10-6B	12
4	Cover (Box Side)	358-723P2	1
5	Sems 6-32 x 5/16	83A-6-5B	16
6	Side Plate Assembly (Left) consisting of:	358-700-C3	1
	Side Plate, Left	358-709	1
	Bearing	5A-34	4
	Bearing	5A-33	5
7	Shoulder Screw	154-706	8
8	Spacer (Tie Rod)	358-707	4
9	Sems 10-32 x 3/8	83D-10-6B	12
10	Cover (Box Side)	358-723-P1	1

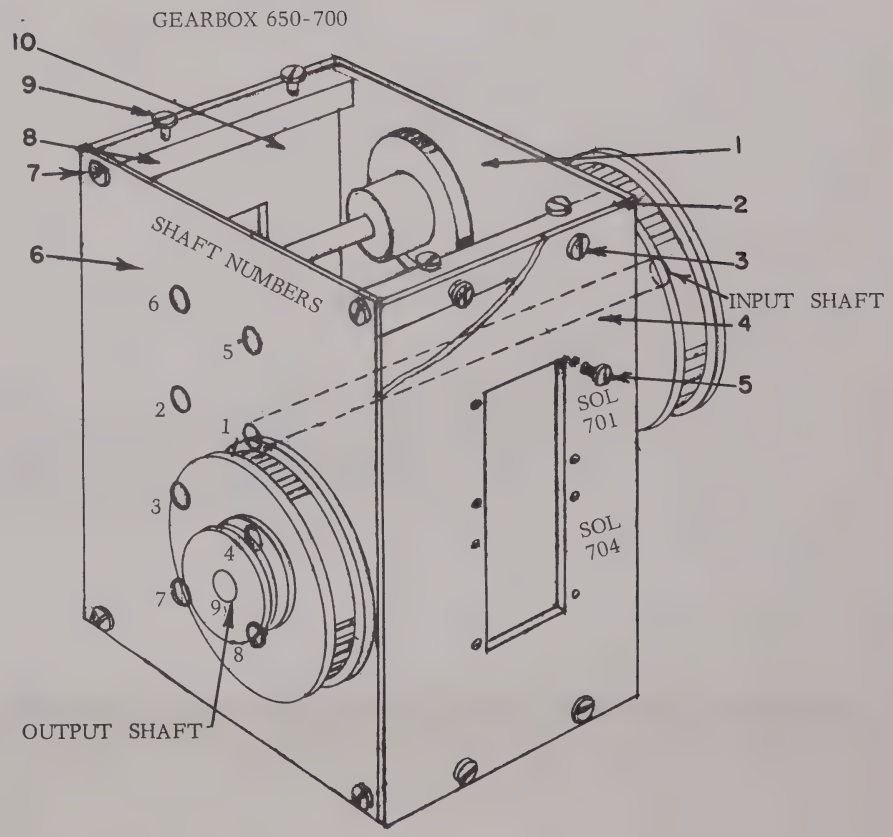


FIGURE 29. RECORDER GEARBOX ASSEMBLY MODEL 650-700

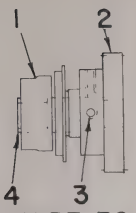


FIGURE 30.
CLUTCH HUB
ASSEMBLY

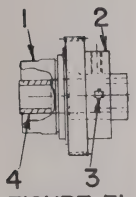


FIGURE 31.
CLUTCH HUB
ASSEMBLY

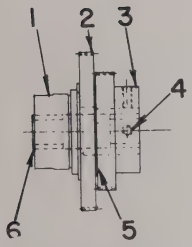


FIGURE 32.
CLUTCH HUB
ASSEMBLY

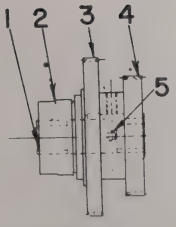
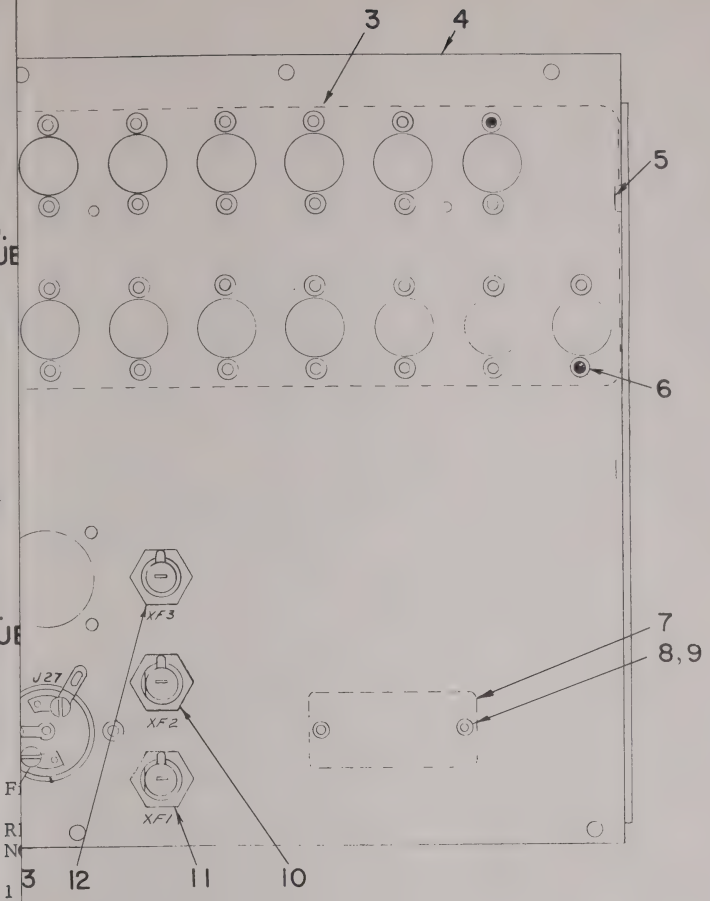


FIGURE 33.
CLUTCH HUB
ASSEMBLY

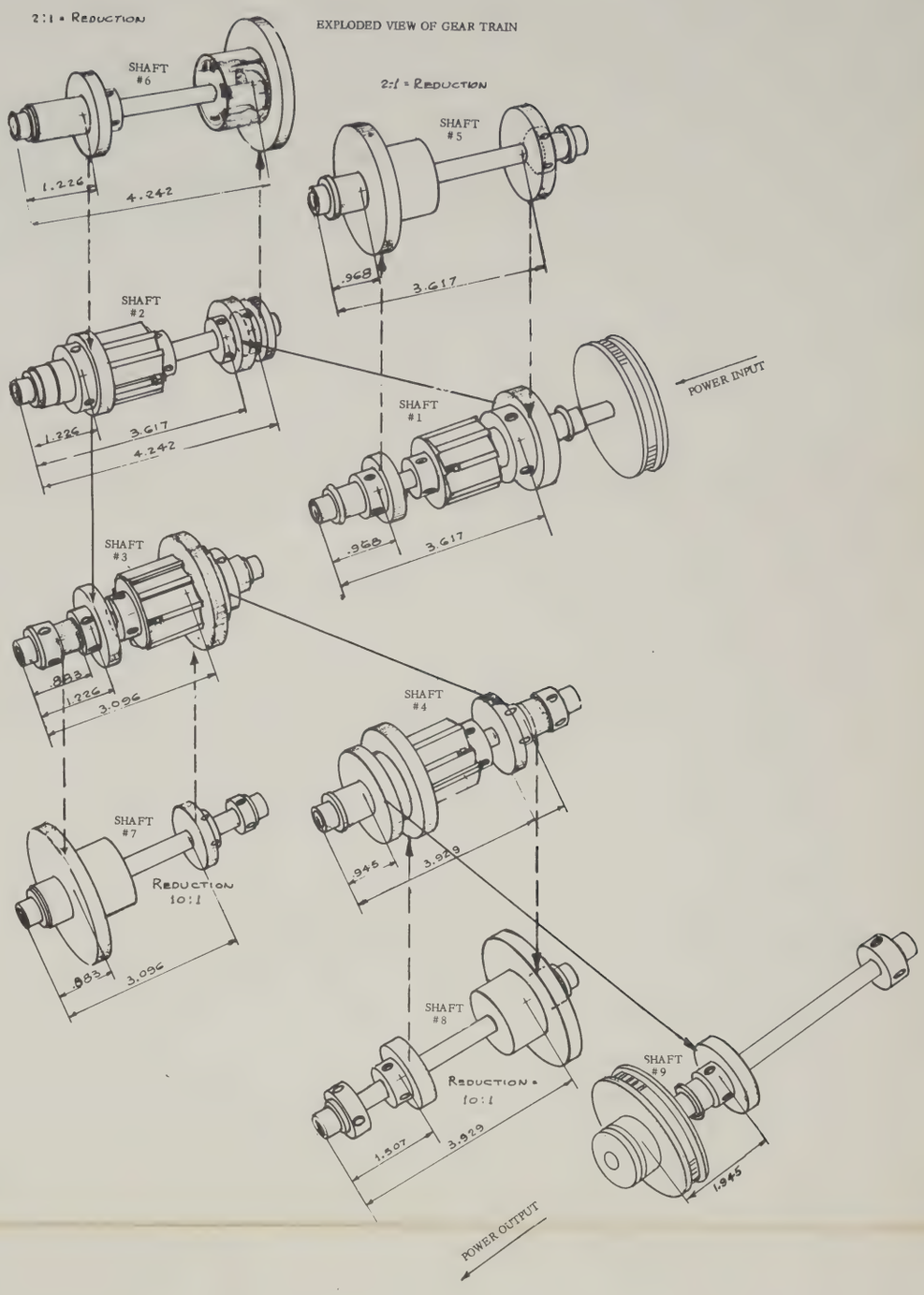


AR RECORDER PLATE

	Nameplate	650-102	1		
	Pems 2-56	40P-2-3	2		
	Pems 2-56	40P-2-3	2		
	Fuse, 1.25 amp slow blow (F2)	26B-14	1	2	MDL(BUS)
	Fuse Holder (XF2)	26H-2MS	1		
	Fuse, 5 amp (F1)	26B-12	1	2	312005(LIT)
	Fuse Holder (XF1)	26H-2MS	1		
	Fuse, 2.5 amp slow blow (F3)	26B-10	1	2	MDL(BUS)
	Fuse Holder (XF3)	26H-2MS	1		
	Connector (J27)	10G3-9MX	1	1	7486G(GRA)
	Sems 6-32 x 1/4 long	83A-6-4B	2		
	Pems 6-32	40P-6-3	6		
	Lugs, RA	34A-5A	2		
	Muffin Fan (B1)	38F-9	1	1	(ROT)
	Fan Grille	38F-9A	1		
	Clip, Fan Mounting	38F-9	1		
	Pems 6-32	40P-6-3	6		
	Screw, Flat Head 6-32 x 5/16 long	80A-632-5D	4		

Figure 29. GEAR BOX ASSEMBLY 650-700-C11

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
	SHAFT #1 (Parts are called from left to right on Figure.)				
1	Shaft #1	825-28	1		
2	Spacer	358-716-P3	1		
3	Allen Head Set Cup Point 8-32 x 1/4	81A-832C	2		
4	Gear	5G-30	1		
5	Shaft Adapter	358-704	1		
6	Sleeve	358-705	1		
7	Spring (Clutch)	358-706	1		
8	Clutch Hub Assembly (See Figure 30)	650-700-C10	1		
9	Spacer	358-716-P1	1		
10	Pulley	5P-12	1	1	
11	Allen Set Screw, Cup Point 8-32 x 3/16	81A-832B	2		
	SHAFT #2 (Parts are called from left to right on Figure.)				
1	Shaft #2	825-6	1		
2	Spacer	358-716-P2	1		
3	Clutch Hub Assembly (See Figure 31)	358-700-C4-P1	1		
4	Spring (Clutch)	358-706	1		
5	Sleeve	358-705	1		
6	Shaft Adapter	358-704	1		
7	Allen Set Screw, Cup Point 10-32 x 1/4	81A-1032G	2		
8	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
9	Gear	5G-33	1		
10	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
11	Gear	5G-30	1		
	SHAFT #3 (Parts are called from left to right on Figure.)				
1	Shaft #3 & #4	825-7	1		
2	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
3	Gear	5G-32	1		
4	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
5	Gear	5G-33	1		
6	Allen Set Screw, Cup Point 10-32 x 1/4	81A-1032G	2		
7	Shaft Adapter	358-704	1		
8	Sleeve	358-705	1		
9	Spring, Clutch	358-706	1		
10	Spacer	358-716-P1	1		
11	Clutch Hub Assembly (See Figure 32)	358-700-C4-P2	1		
	SHAFT #4 (Parts are called from left to right on Figure.)				
1	Shaft #3 & #4	825-7	1		
2	Spacer	358-716P1	1		
3	Clutch Hub Assembly (See Figure 33)	358-700-C1P4	1		
4	Spring Clutch	358-706	1		
5	Sleeve	358-705	1		
6	Shaft Adapter	358-704	1		
7	Allen Set Screw, Cup Point 10-32 x 1/4	81A-1032G	2		
8	Gear	5G-33	1		
9	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
10	Gear	5G-32	1		
11	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
	SHAFT #5 (Parts are called from left to right on Figure.)				
1	Shaft #5	825-9	1		
2	Spacer	358-715-P2	1		
3	Gear	5G-31	1		
4	Mini Clutch 61 H.U.	5C-4	1		
5	Allen Set Screw, Cup Point 6-32 x 1/8	81A-632A	2		
6	Gear	5G-35	1		
7	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
8	Spacer	358-715-P3	1		
	SHAFT #6 (Parts are called from left to right on Figure.)				
1	Shaft #6	825-8	1		
2	Spacer	358-715-P1	1		
3	Gear	5G-35	1		
4	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
5	Gear	5G-31	1		
6	Mini Clutch 61 H.U.	5C-4	1		
7	Allen Set Screw, Cup Point 6-32 x 1/8	81A-632A	2		
	SHAFT #7 (Parts are called from left to right on Figure.)				
1	Shaft #7 & #8	825-5	1		
2	Spacer	358-715-P4	1		
3	Gear	5G-34	1		
4	Mini Clutch 61 H.U.	5C-4	1		
5	Allen Set Screw, Cup Point 6-32 x 1/8	81A-632A	2		
6	Gear	5G-29	1		
7	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
8	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
9	Collar	358-717	1		
	SHAFT #8 (Parts are called from left to right on Figure.)				
1	Shaft #7 & #8	825-5	1		
2	Collar	358-717	1		
3	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
4	Allen Set Screw, Cup Point 8-32	81A-832C	2		
5	Gear	5G-29	1		
6	Gear	5G-34	1		
7	Mini Clutch 61 H.U.	5C-4	1		
8	Allen Head Set Screw, Cup Point 6-32 x 1/8	81A-632A	2		
9	Spacer	358-715-P4	1		
	SHAFT #9 (Parts are called from left to right on Figure.)				
1	Shaft #9	825-27	1		
2	Pulley	5P-6	1	1	
3	Allen Set Screw, Cup Point 8-32 x 3/16	81A-832B	2		
4	Spacer	358-715-P3	1		
5	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
6	Gear	5G-35	1		
7	Collar	358-717	1		
8	Allen Set Screw, Cup Point 8-32 x 1/4	81A-832C	2		
	GEAR BOX	358-700			
1	Cover (Lucite Top)	358-721	1		
2	Side Plate Assembly (Right) consisting of:	358-700-C2	1		
	Side Plate, Right	358-708	1		
	Bearing	5A-34	4		
	Bearing	5A-33	5		
3	Sems 10-32 x 3/8	83D-10-6B	12		
4	Cover (Box Side)	358-722P2	1		
5	Sems 6-32 x 5/16	83A-6-5B	16		
6	Side Plate Assembly (Left) consisting of:	358-700-C3	1		
	Side Plate, Left	358-709	1		
	Bearing	5A-34	4		
	Bearing	5A-33	5		
7	Shoulder Screw	154-706	8		
8	Spacer (Tie Rod)	358-707	4		
9	Sems 10-32 x 3/8	83D-10-6B	12		
10	Cover (Box Side)	358-723-P1	1		



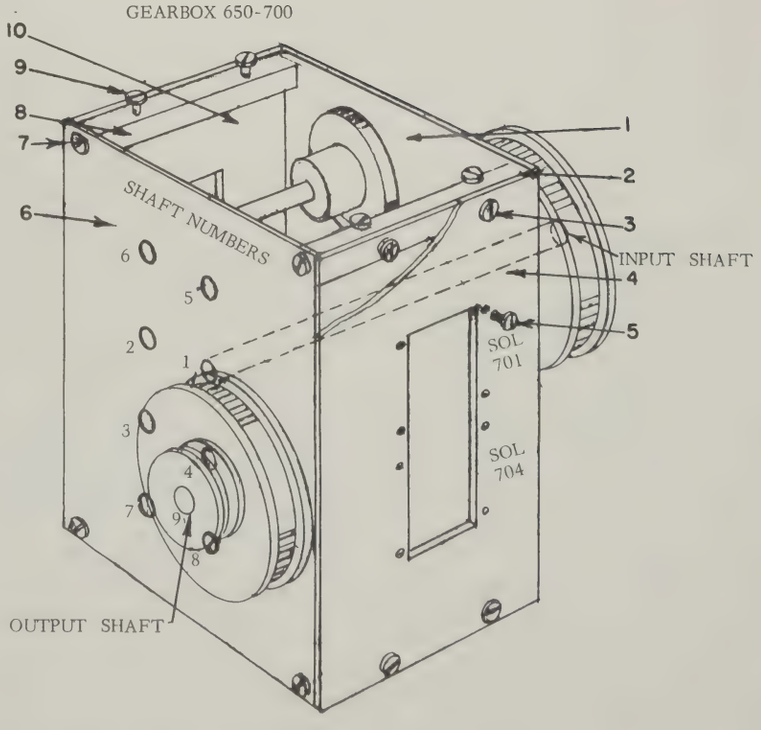


FIGURE 29. RECORDER GEARBOX ASSEMBLY MODEL 650-700

FIGURE 30. CLUTCH HUB ASSEMBLY

Figure 30. CLUTCH HUB ASSEMBLY 650-700-C10

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Hub	358-703	1		
2	Gear	5G-102	1		
3	Set Screw, Socket Head 8-32 x 1/4	- -	2		
4	Bearing (Oilite) .437 O. D. 31-25/3130 I. D. .375 long	- -	2	1	(SAN)

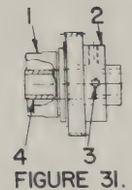


FIGURE 31. CLUTCH HUB ASSEMBLY

Figure 31. CLUTCH HUB ASSEMBLY 358-700-C4-P1

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Hub	358-703	1		
2	Gear	5G-36	1		
3	Allen Head Set Screw (Parkerized) 1/4 x 8-32	- -	2		
4	Bearing (Oilite) .437 O.D. $\frac{.3125}{.3130}$ I.D. .375 long after assembly	- -	1	1	(SAN)

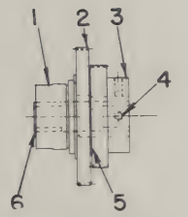


FIGURE 32. CLUTCH HUB ASSEMBLY

Figure 32. CLUTCH HUB ASSEMBLY 358-700-C4-P2

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Hub	358-703	1		
2	Gear	5G-28	1		
3	Gear	5G-36	1		
4	Allen Head Set Screw (Parkerized) 1/4 x 8-32	- -	2		
5	Spacer Gear Box	710A-11	1		
6	Bearing (Oilite) .437 O.D., $\frac{.3125}{.3130}$ I.D. .375 long after assembly.	- -	1	1	(SAN)

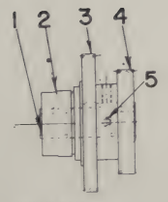


FIGURE 33. CLUTCH HUB ASSEMBLY

Figure 33. CLUTCH HUB ASSEMBLY 358-700-C4-P4

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Bearing (Oilite) .437 O.D., $\frac{.3125}{.3130}$ I.D. .375 long after assembly.	- -	2	1	(SAN)
2	Hub	358-703	1		
3	Gear	5G-28	1		
4	Gear	5G-36	1		
5	Allen Head Set Screw (Parkerized) 1/4" x 8-32	- -	2		

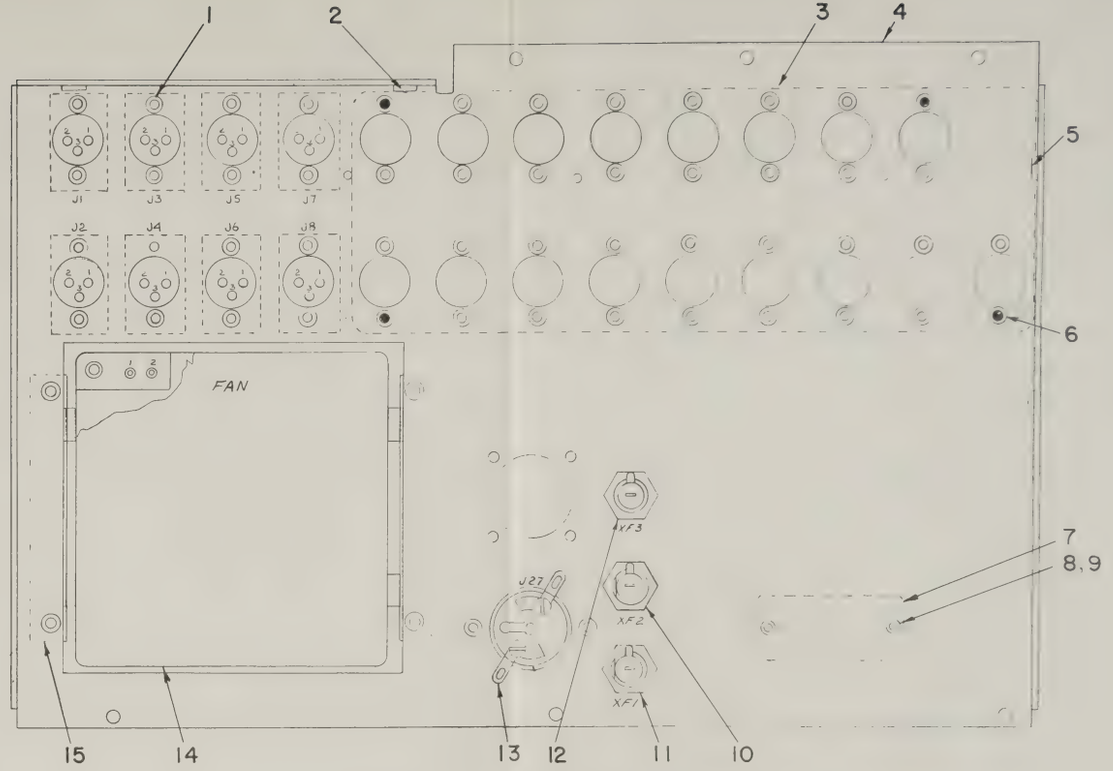


FIGURE 34. REAR RECORDER PLATE

Figure 34. PLATE ASSEMBLY, REAR RECORDER, 650-100-C14 (8-CHANNEL), 650-100-C29 (14-CHANNEL), 650-100-C30 (18-CHANNEL), 650-100-C31 (25-CHANNEL).

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Connector, 3-pin	10F3-3MX			XLR-3-32(CAN)
	J1 - J8 (8-Channel)		8	4	
	J1 - J14 (14-Channel)		14	7	
	J1 - J18 (18-Channel)		18	9	
	J1 - J25 (25-Channel)		25	13	
	Screw 4-40 x 1/4 Oval Head	80A-440-4E			
	(8-Channel)		16		
	(14-Channel)		28		
	(18-Channel)		36		
	(25-Channel)		50		
	Pem 4-40	40P-4-3	50		
2	Pems 8-32	40P-8-3	4		
3	Plate Cover (8-Channel)	650-146P1	1		
	(14-Channel)	650-146P2	1		
	(18-Channel)	650-146P3	1		
4	Plate, Recorder Rear	650-107	1		
5	Pems 8-32	40P-8-3	4		
6	Sems 4-40 x 5/16 long	83A-4-5B	4		
7	Nameplate	650-102	1		
8	Pems 2-56	40P-2-3	2		
9	Pems 2-56	40P-2-3	2		
10	Fuse, 1.25 amp slow blow (F2)	26B-14	1	2	MDL(BUS)
	Fuse Holder (XF2)	26H-2MS	1		
11	Fuse, 5 amp (F1)	26B-12	1	2	312005(LIT)
	Fuse Holder (XF1)	26H-2MS	1		
12	Fuse, 2.5 amp slow blow (F3)	26B-10	1	2	MDL(BUS)
	Fuse Holder (XF3)	26H-2MS	1		
13	Connector (J27)	10G3-9MX	1	1	7486G(GRA)
	Sems 6-32 x 1/4 long	83A-6-4B	2		
	Pems 6-32	40P-6-3	6		
	Lugs, RA	34A-5A	2		
14	Muffin Fan (B1)	38F-9	1	1	(ROT)
	Fan Grille	38F-9A	1		
15	Clip, Fan Mounting	38F-9	1		
	Pems 6-32	40P-6-3	6		
	Screw, Flat Head 6-32 x 5/16 long	80A-632-5D	4		

e 35. REFLECTOR & COVER ASSEMBLY 650-100-C25

DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
Spring	650-168	1		
Screw, Shoulder	838-15	1		
Flatwasher	710A-17	2 or as reqd.		
Arm Assembly (Post Dev. Lamp) consisting of:	650-100-C27	1		
Arm, Right (Post Dev. Lamp)	650-170	1		
Arm, Left (Post Dev. Lamp)	650-171	1		
Bar, Tie (Post Dev. Lamp)	650-174	1		
Flatwasher	710A-17	1		
Grommet, Rubber	77A-52	1		
Screw, Shoulder	838-15	1		
Spring	650-168	1		
Eyelet	20A-22	1		
Cover	650-173	1		
Nameplate	652-82	1		
Rubber Channel 23-1/8 long	RC-1	1		
Reflector Assembly (See Figure 36)	650-100-C24	1		
Sems 6-32 x 3/16 long	83A-6-3B	2		
Rivet tapped	47M-1	2		

e 36. REFLECTOR ASSEMBLY 650-100-C24

DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
Socket, Lamp	60A-35	4		
Lugs, Soldering	34A-12	8		
Sems, 6-32 x 3/16 long	83A-6-3B	4		
Switch, Push Button (S8)	62A-17	1	1	A209(STOC)
Backing Strip, Switch	650-172	1		
Screw, Binder Head 4-36 x 3/8 long	80A-436-6B	1		
Lockwasher #4	73A-4	1		
Reflector	650-169	1		

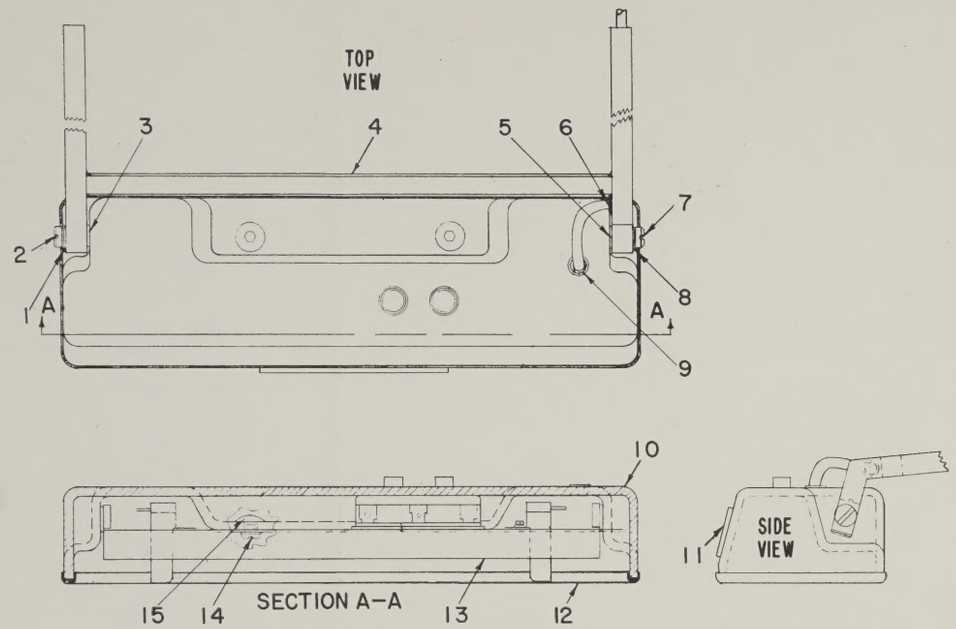


FIGURE 35. REFLECTOR AND COVER ASSEMBLY

Figure 35. REFLECTOR & COVER ASSEMBLY 650-100-C25

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Spring	650-168	1		
2	Screw, Shoulder	838-15	1		
3	Flatwasher	710A-17	2 or as reqd.		
4	Arm Assembly (Post Dev. Lamp) consisting of:	650-100-C27	1		
	Arm, Right (Post Dev. Lamp)	650-170	1		
	Arm, Left (Post Dev. Lamp)	650-171	1		
	Bar, Tie (Post Dev. Lamp)	650-174	1		
5	Flatwasher	710A-17	1		
6	Grommet, Rubber	77A-52	1		
7	Screw, Shoulder	838-15	1		
8	Spring	650-168	1		
9	Eyelet	20A-22	1		
10	Cover	650-173	1		
11	Nameplate	652-82	1		
12	Rubber Channel 23-1/8 long	RC-1	1		
13	Reflector Assembly (See Figure 36)	650-100-C24	1		
14	Sems 6-32 x 3/16 long	83A-6-3B	2		
15	Rivet tapped	47M-1	2		

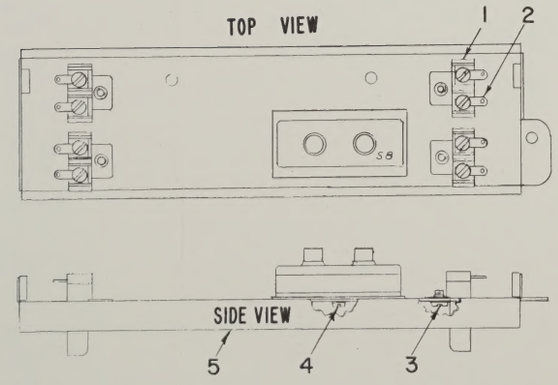


FIGURE 36. REFLECTOR ASSEMBLY

Figure 36. REFLECTOR ASSEMBLY 650-100-C24

REF. NO.	DESCRIPTION	SANBORN NO.	T.Q.	R.S.	VENDOR NO.
1	Socket, Lamp	60A-35	4		
2	Lugs, Soldering	34A-12	8		
3	Sems, 6-32 x 3/16 long	83A-6-3B	4		
4	Switch, Push Button (S8)	62A-17	1	1	A209(STOC)
	Backing Strip, Switch	650-172	1		
	Screw, Binder Head 4-36 x 3/8 long	80A-436-6B	1		
	Lockwasher #4	73A-4	1		
5	Reflector	650-169	1		